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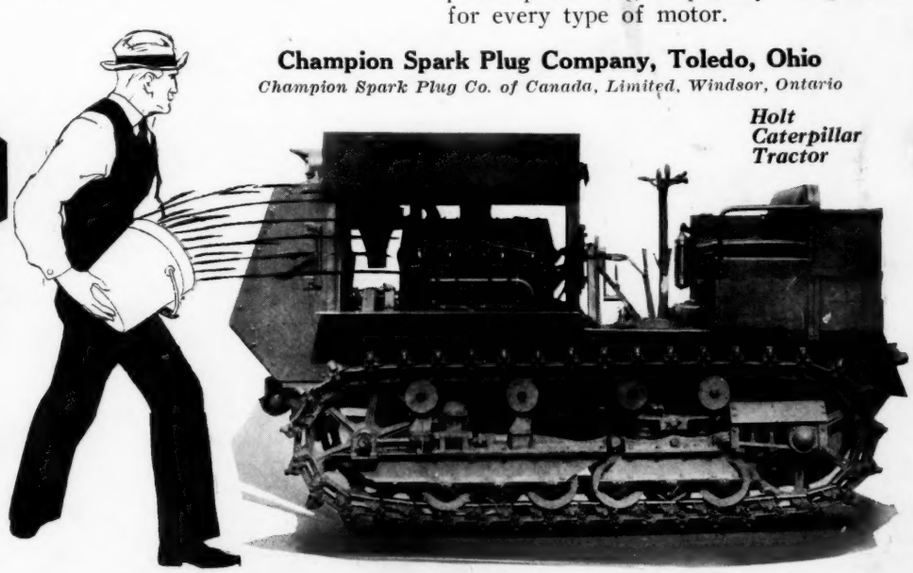

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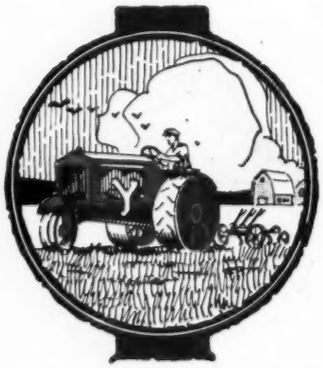

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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European Expansion Under War Pressure

Post-War Models Not Ready—Electric Starting and Lighting Universal—Huge Factory Enlargement

Part I

By David Beecroft

LONDON, Jan. 21—Two months have not been sufficient for European automobile manufacturers to get converted from war to a peace program. That time has not been long enough for many to decide on what their peace program shall be. For more than 4 years they have worked on a war program only. Their peace organizations have been completely disrupted. With many, their manufacturing organizations have been disrupted as compared with 1914. Some have been very largely without engineering organizations since that date. Others have lost many from their organizations who were heads of departments in 1914. The peace manufacturing momentum ceased to exist long ago.

Factories were placed under government control in most instances and were largely prevented from going ahead with post-war activities. Many of the British factories were expressly forbidden from utilizing any of their engineers in the development of post-war models.

Few Completely Converted

There were a few factories that were turned entirely from automobile manufacture to aircraft. A case in point is that of the Sunbeam, whose automobiles have been manufactured during the war and used as officers' cars; but these have not been built in the Sunbeam factory, but in other British factories, while the Sunbeam company has had to devote its energies almost exclusively to the development and production of engines for aircraft uses.

Industry Not Ready for Peace

What is true of this factory is true of many others to a very great extent, and the miraculous would have happened if these factories had been able in a month or 6 weeks to turn from peace into war and get on a development basis. In every factory, and in practically every industry, the general comment is that it was relatively easy to move from peace into war in 1914 and 1915, but it is a herculean task to transform the greatly increased factory capacities from war into peace.

It is true of Great Britain, France and Italy that up until Armistice day they had not contemplated an early peace and were going ahead on the basis of at least one more year of war, and perhaps 18 months.

There was no slowing up of development, while many factories had been doubled, tripled, quadrupled, and in some cases increased tenfold in manufacturing capacity; the work of expansion was not completed.

New buildings were going up on every hand.

Some factories had additions under operation which would give a 25 per cent further increase in capacity. This increase was all based on a war program. Peace did not enter into it.

Suddenly, on Nov. 11, this came to an unexpected end. In the short space of one hour the entire program was changed. The active belligerent stage of war was over, and these industries for the first time since 1914 thought of peace. For the first time they were face to face with the stupendous problem of passing from the stage of war activity into a peace program.

Up to that time many had not given it any consideration. It is true the leaders of these industries had been analyzing the situation, but help was scarce and demand for production so high and Government insistence on a 100 per cent war program so intense that nothing active had been done in 80 per cent of the cases.

Some Factories Favored

There are exceptions to this condition. Some of the factories received more favorable treatment from the Government. The exact reason for this is not known. During the war a few of them were able to work along their previous lines. For example, the Vauxhall company in England was manufacturing its cars for war use during the entire period and so is in a preferred position to talk deliveries, specify dates and quote prices. It has even been able to develop a post-war model which has passed through the development stage and is ready for production.

In Italy, Fiat has been manufacturing both passenger cars and trucks in tremendous quantities during the war and has also been developing post-war models and has on hand great volumes of material with which to push these into production. Fiat's post-war models have been tested out for many months. They are in production, and a program for world-trade is moving ahead.

In France, Renault, which has had an amazing increase in manufacturing capacity, has been permitted to go ahead in the development of post-war models and has these well developed and almost ready for production.

In England, Crosseley has been devoting a large percentage of its factory to the production of a light high-speed van for the Royal Air Force, the chassis being a development of the pre-war model. Its manufacturing organization on this model has not been molested, but very greatly increased, so that its capacity of fifty cars a month before the war has been increased to 250 per month now, and it is into production on a program of 3000 cars per year of its 25-30-hp. type, and is getting ready for a program of 7000 additional on its new 15-hp. model, which is a development of the war and is counted as one of Great Britain's post-war models.

20% Will Have Big Start

With many other companies the conditions are similar, and at least 20 per cent of the industry in Great Britain, France and Italy is going to have a big start over the remaining 80 per cent in the question of production and getting back into the market.

From a canvass of over forty firms manufacturing automobiles in England, the conclusion is that very few are ready to quote chassis specifications, delivery dates or prices. They are all working on post-war models. It would be impossible to make deliveries before October or November, and, owing to the uncertainty of the material market, the quoting of prices was out of the question.

Several stated they were endeavoring to produce as good and cheap a car as it was possible to produce. Others frankly stated that their post-war prices on continued models were 50 to 75 per cent higher than 1914 prices, due to increased cost of labor, higher cost of materials, and to this might be added the expense these organizations must face in rebuilding their entire factory scheme for automobile production.

There will not be a comprehensive display of post-war models in Europe until the Olympia Exposition, which is scheduled to take place in London in November, and even at that time several of the post-war models will only be in a semi-completed stage of development.

No Low-Priced Models

France is holding in March her great industrial fair at Lyons, where most of the French and Italian manufacturers, as well as some of the British and American, will exhibit. In a few cases there will be post-war models exhibited by such firms as Fiat, Renault, Crossley, Vauxhall, Austin, Argyle, Peugeot, and one or two others.

The majority of the remaining firms will show models that are continuations of pre-war types. The Lyons Fair is not merely an automobile exhibit, but an industrial exhibit of all French industries, and marks France's initial step in her efforts to get into industry. The world will have to wait until November to get a correct measure of what Europe is going to build in the way of post-war models.

It is possible at present to outline in a general way what is coming through in the post-war model field. *One thing is certain, namely, that there is not going to be a landslide movement into the low-priced cars selling at* $1,000 *or thereabouts and which models will serve as rivals for the American car in that field.*

For the present Great Britain has almost deserted the cheap car field. There is no tendency as yet for new models that will compete with the cheap American car. In France, Renault, with a new production job which is expected to sell at about $1,000, looks like the most aggressive factor in American competition. Fiat is a close second, although its price is not yet definite.

British Cars High Priced

The majority of the British factories still incline to the high-priced automobile. As an example of this, Daimler will sell as its cheapest model a 30-hp. six-cylinder car at $4,500. This same model formerly sold at approximately $3,800. Napier will market a six-cylinder car at $5,000. One of the Vauxhall models lists at $5,900, and the other at a little less. Austin has a new model, a real post-war type, which will sell at approximately $2,000. Rover has a model which before the war sold at $1,750 and is now listed at over $2,000.

Very few announcements of prices have been made in the smaller field. The 10-hp. four-cylinder Singer is listed at $1,375, and a Belsize at $2,100 which formerly sold at approximately $1,500. The B.S.A. small car which was brought out by the Birmingham Small Arms Co., as the adaptation of the Ford in England but on an expensive design basis, has been discontinued, and this large concern apparently gone out of what might be interpreted as the low-car field.

In France the Citrogen company, a new organization, which previous to the war was a large manufacturer of gears, but which during the war grew to be one of the greatest factories in Paris, is planning to go into a cheap car production, but has nothing definite as yet.

All Europe is going into the equipment of post-war models with electric starting and lighting as standard. There will not be a single exception to this, even in the cheapest cars. Every concern has decided on this policy, and accessory manufacturers are under way in the production of generators, starting motors and batteries.

The question of standardizing on these parts has already been taken up in Great Britain by the Institution of Automobile Engineers; committees have been formed for starting battery standardization, and the sentiment is that plate dimensions will be standardized. The sentiment is to work as close as possible to American standards.

With electric starting motors outside dimensions only are going to be standardized at present. The committee having this work in hand is making good progress.

The committee having the standardization work of electric generators in charge has not started on this job as yet.

Starting motors are going to be mounted in practically the same way as in America, and in the majority of cases will drive by pinion into a ring of teeth on the flywheel. Already some of the large manufacturers have developed motor drives for this use.

Value-in-Head Design Increases

With regard to the generator, manufacturers are not so agreed. In the final post-war models they undoubtedly will be incorporated in the engine very similar to the American practice, but for the present not a few are going to be mounted on the front arms of the crankcase and driven by belt. Belt-drive will undoubtedly disappear as the development of the models crystallize. The case seems a parallel with the introduction of the magneto years ago in America when our early models were chain-driven.

There is every promise of considerable movement throughout England, France and Italy toward the valve-in-head design of engine. This may not appear in the first post-war models, but is receiving considerable attention by the leading engineers. The fuel question is so acute in all European countries that the increase of fuel efficiency is certain to have a very definite effect on engine design.

The reading of a paper in January by L. H. Pomeroy, Vauxhall engineer, on experiments with valve-in-head designs and its reception by the majority of the engineers in the country is an indication of what can be expected. The new four-cylinder Vauxhall with a horsepower rating of 30-98 is of this type, and is looked upon as one of the finest performing cars in Europe. Its cylinder dimensions are 98 by 150 mm. In Italy, while the valve-in-the-head design has not actually appeared, it was frankly admitted that it is under serious consideration. The same is true in France.

Aluminum Alloy Development

As suggested by Mr. Pomeroy in his address on valve-in-the-head design, one of the strong reasons for it being favored is the fact that it is much easier to mount the engine accessories, such as starting motor, generator, etc., with a valve-in-the-head design than with a T-head or L-head design. His experiments with valve-in-the-head design also established the point that with valves in this position diameter is not so great a factor and that intake gas velocities can be increased very greatly without any deterrent effect on the efficiency of the engine.

The use of detachable cylinder heads is under way and is destined to make considerable progress. It has attractions because of its manufacturing possibilities and also because of the fuel situation.

Great Britain has made wonderful strides in the development of aluminum-copper alloys for piston manufacture. This work has been pioneered by the aircraft development. The National Physical Testing Laboratory at Teddington, a suburb of London, has been working on this subject during the entire period of the war and has made great development. The aluminum alloy piston has come into general use and due recognition has been taken of its effect on the thermal characteristics of the engine.

Special Steels Developed

The development of a special grade of automobile steels was aggressively taken up by the British automobile makers and the steel manufacturers over 18 months ago. For a period of 11 months they concentrated on the development of twenty steels which were approved some months ago as standard automobile steels, and the steel manufacturers started production on them last fall. These had been adopted as standard steels by the Engineering Standards Committee, which is the national organization that finally decides on standards in all industries.

Once a specification or design is approved by this committee it is immediately accepted by all the manufacturers as a standard and is so considered in their complete manufacturing program. The sentiment was freely expressed that American steel specifications did not measure up to the requirements of the British manufacturer, and the new adopted list of steels is a result of the manufacturer's effort to put an automobile on as high a standard as possible.

This suggests the fact that there is throughout England no sentiment in favor of dropping from her high standard of material and workmanship that existed previous to the war. Her factories have learned great lessons in production. They have been filled with the best machinery, and some of the factories state they are doing machine costs lower than in America, yet notwithstanding this they are going to maintain their reputation for the very highest grade of workmanship and are going beyond pre-war standards in the use of high-grade materials.

No Decrease in Quality

The lessons of production have not blinded them to the desirability for a high-grade product. Good workmanship and the necessity for it have increased in Europe because of the war. All war products have to be made on a high standard of accuracy. The consequent aim was to produce the product that would give the best results. The production of the very best grade of ammunition permeated every factory and every home in England and France. Its objective of accuracy has impressed its lesson on the entire nation. At the same time the possibilities of production have been realized and appreciated. Production methods are going ahead, but there is going to be every precaution taken to prevent the sacrifice of quality for a little gain in production.

It was impossible during December when the Italian and French factories were visited, and during January when the British factories were visited, to gage correctly the possibilities of increased production in these factories on post-war models. Many of the companies had not ceased their war activities. Some of them will not be through with Government orders on aircraft engines for another 6 months.

Most of them have ceased the manufacture of shells, but several were still going on and expected to continue for several months on the building of airplanes of large bombing types, and on parts of aircraft engines and other lines of munitions.

It was unreasonable to look for production systems in factories that since the start of the war had been under Government control and were continuing on Government contracts. Much of the new machinery installed was installed especially for war work, and there was not to be seen a good deal of the multiple spindle type of machine

that is so generally used in America for production methods on automobile parts.

You looked in vain for progressive assembly systems, even with those companies that have been manufacturing cars for war uses. It was a little disappointing not to find well worked out progressive assembly systems in such factories. They are distinctly behind America in this respect.

There were three exceptions: Ford at Manchester has an assembly system as good as anything in the Ford factories in America. The large British truck manufacturer, the Associated Equipment Co., has a well worked out progressive assembly system in the form of what might be designated a traveling sidewalk which carries not only the chassis under assembly but the workers as well, so that the workers move along with the chassis or parts they are working upon.

Renault had perhaps the best example of progressive assembly on the continent in his aviation assembly room, where each engine is carried through assembly on a moving stand which is a conventional type mounted on wheels which travel in a U-track in the floor.

Little Progressive Assembly

In all of the other factories no effort had been brought into actual operation by way of progressive assembly. It was unreasonable to expect any such thing excepting in those factories that had been engaged on car production during the war. It must be remembered that America's great steps in production methods have been made since 1914 and that the majority of the European manufacturers have had little opportunity since then to come to America and study our methods.

In some of the accessories factories excellent manufacturing methods have been adopted. This is particularly true in some of the British magneto factories that have been developed under Government pressure during the war and which represent some of the most modern factories in existence. Everything modern has been installed. The lighting has been brought right to the side of the head of the worker where glare in the eye is impossible and where the greatest illumination possible on the work is obtained.

The workbenches and tables have been laid out with special regard for the work. Small assembly trays are in use with separate compartment to contain all of the parts used in the assembly of any part of the magneto. Where the condensers are being assembled there are glass sides to the working tables, so that there can be no possible interference by the wind or other agents in the speed of the work. Suitable foot rests are provided for the workers, whether women or men. The same applies to chairs. It would be almost impossible to conceive of any improvement that might be added in some of these factories.

Too Much Littering Up

There are some of the other factories where the fundamentals of production have not been studied and applied as they should. Not sufficient attention has been made to the clean-desk idea in assembly. You would see assembly benches where the parts are piled promiscuously along the center of the benches without regard to the rows of workers on the sides. Mental confusion can only follow such practices. Not a few of the manufacturers were aware of the handicap of such methods, but seemed to feel that under the stress of war they had not the available energy to revamp a system.

In some of the largest aircraft factories—and this criticism might apply to most of the factories, in the automobile, truck and aircraft industries—there is a lack of benches or racks, or crates, call them what you will, to carry the raw material or partly finished material awaiting at the different machines; and other racks to receive the material after it had been worked upon by the machine. There was too much throwing of parts on the floor or putting them in very inefficient boxes.

There was a general realization that throwing anything on the floor is inefficient. It was realized, too, that special racks for crankshafts, camshafts and all parts in the process of construction were desirable, but that the enormous pressure of expansion during the war had made it difficult to get into this aspect of production as many had desired to do. It must not be inferred that there were not in many factories very complete equipments in the way of racks and benches.

Electric Industrial Trucks Used

The use of industrial electric trucks is general in several factories, and in the majority of the others the factory managers had been endeavoring for nearly a year to get such, but were unable to do so. Fiat received its first half dozen of such trucks from American in December. They had been on order for more than a year. Several of the French factories had been trying to get such for months but without avail.

In the absence of these trucks there has sprung up a very general use of overhead trolleys for moving material and also the use of the miniature trolley system along the factory aisles. Very narrow gage steel rails are laid in the concrete flooring and hand trucks in trains of two or three are pushed along these tracks.

Where factory development has been enormously great, as in the case of Renault, which before the war had 4500 workers and now has 23,000, the use of motor vehicles to transport material from one building to another and into and through the buildings as well, has been developed. Renault employs a small passenger chassis fitted with very small diameter wheels with solid tires. These are driven by girls, who operate the vehicle only, the loading and unloading being done by men. These vehicles are very efficient in transporting from building to building, as well as in some of the larger departments.

Factories Greatly Enlarged

Nothing is more impressive to the visitor of Europe than the new factories. When contrasted with the factories that existed in 1912, you get an immediate conception of what the war has meant to France, England and Italy. You get a new realization of what is conveyed by the oft-used phrase "a war of mechanics." The mechanical devices before the war have to a very large extent been the products of the automobile and motor truck manufacturer.

Renault is a typical example in France of this. The factory has grown out of all pre-war proportions. It has grown beyond the conceptions of the Renault organization of 2 years ago. None of the manufacturers in 1914 or 1915 had any conception of what 1918 would accomplish. As a result many of the factories are not as organized and symetrically laid out as might be expected. Renault, for example, increasing more than fivefold, has spread all over the lot, so to speak, and while the organization in the different buildings is generally good, there is naturally a manufacturing loss because of the number of different buildings and the location of them. Because of the variety of manufacture it was also impossible to build up under war pressure any broad scheme of factory layout. Because of this there will be much rearrangement taking place during the present year.

(To Be Continued)

S. A. E. Discusses Truck Subjects

1—Pneumatic Tires for Trucks

B. B. Bachman

2—Summary of Truck Engineering

Cornelius T. Myers

3—Keeping 40,000 Army Trucks Running

G. E. Randles

NEW YORK, Feb. 11.—Three papers covering truck subjects were presented last night at a meeting held at the Automobile Club of America, under the auspices of the Metropolitan Section, Society of Automotive Engineers. Cornelius T. Myers, consulting engineer, Avenel, N. J., presented a general summary of truck engineering development; B. B. Bachman gave a paper on pneumatic tires on trucks, and G. E. Randles, until recently director, Division of Maintenance, Motor Transport Corps, told of some of the problems in keeping 40,000 army motor trucks in operation.

Mr. Bachman reached some important conclusions in the field of the pneumatic tire for the motor truck. He gave it as his opinion that for vehicles up to 1500 lb. capacity pneumatic tires only are proper. From 2000 to 3000 lb. inclusive there is a strongly marked tendency toward pneumatics which it is believed will develop continuously. On the 2 and 2½-ton trucks they are just making an appearance, and are still in the experimental stage, while on the larger size there is practically no evidence apparent that the heavy pneumatics will be used.

The reasons given for these conclusions are taken up definitely in Mr. Bachman's paper, which is digested herewith. The subject is one of intense importance because of the growing use of motor trucks for long-distance carrying. Furthermore, as the use of pneumatic tires is a factor in the decrease of gasoline consumption, and also lessens the depreciation of roads, it is a matter of extreme importance at the present time, when both the fuel and road prolems are being given as close as possible study both independently and as co-related matters.

Room for Detail Improvement

Cornelius T. Myers covered a broad field in his paper, this being in many ways a result of his varied experiences, including that in the design of the Class B truck. Mr. Myers stated frequently that while we have fairly satisfactory development along many lines of truck construction there is a great necessity for detail improvement. Digesting his remarks, they covered the following points:

One of the phases of truck design which has not been given all the attention which it deserves is that of accessibility. In a very large number of instances the question of cost of construction vs. accessibility comes up, and the decision is not always in favor of the accessible method of construction. Mr. Myers made a plea for simplicity, stating that this not only resulted in fewer parts but also in more accessibility. He mentioned a certain concern in this city which is a large buyer of motor trucks which makes a practice of removing from the trucks several parts which in their opinion are superfluous and selling them to other users of the same make of truck.

Comfort for the driver is a highly essential matter in truck design, particularly when it is remembered that trucks are operated for much longer spaces of time than passenger cars; and furthermore, they must be out in all sorts of inclement weather. The driver is compelled, during his attention to his duties, to exert a tremendous amount of nervous energy, and for the general safety of the other occupants of the streets, and for the general good of the apparatus handled, as much should be done as possible to relieve the driver of mental strains.

Mr. Myers touched for a moment on the gain in speed possible with the use of giant pneumatics. The further use of these, he predicted, would result in more attention on the part of designers to the layout of the brake and steering. The speed proposition, however, is a matter of extreme importance when it is realized that for real efficiency it is necessary to keep the trucks moving. The faster the average speed the better paying is the truck. The average speed in taking into consideration the entire period over which the trucks operate is not only governed by the time it spends on the road but also what is lost by waiting or by overhauling.

Transportation Cost Should Come First

According to the author, the cost of transportation by truck should be put first and the cost of the truck next. That is, in laying out a truck transportation system the first cost of the truck should be figured not as standing alone but as being only part of the entire problem of determining exactly what truck transportation is costing the owner of the vehicle or fleet of vehicles. This is a broad gaged method of calculating the value of the truck or fleet of trucks to the owner, but one which is forgotten frequently by the truck purchaser.

In the design of a truck it is very often possible to combine units so that there are parts with double and triple functions. This results in a reduction in weight and increase in simplicity, and often because of the combination of functions a designer is enabled to allow a greater factor of safety and still have finally a lighter part.

In taking up details of construction, Mr. Myers pointed out several directions in which future improvements in truck construction are necessary. Better cooling systems are required, and it is particularly necessary to look into the design of radiators, to see if they cannot be lightened, as a great amount of weight over the front axle results in making the truck hard to steer. Spring suspensions can also be improved. The use of longer springs is increasing, but lubrication of the spring eyes is often faulty; in fact, he stated many spring breakages are directly traceable to the neglect of oiling the spring eyes. This causes the bearing at this point to seize, giving an action which overstresses the main leaf, allowing it to break.

Hearty approval is being given the use of oil fittings instead of grease, but one of the criticisms offered on this method of lubrication is that the oil fittings, in many cases, admit dirt and water. They are also very frequently of

such construction that they are apt to be knocked off and broken.

The magazine system of oiling the spring brackets, as utilized on the Class B truck, was explained in detail, and was shown to have worked out generally satisfactory except at one minor point, which is readily corrected. This is in the use of too loose a fit of the wick, in the case of the front springs. When this wick is too loose the oil rapidly siphons from the reservoir, thus emptying it, and necessitates the renewal of the wick, giving it a tighter fit.

As an example of the real influence of this method of oil lubrication on ease of spring suspension Mr. Myers mentioned a truck utilized in transporting berries on the Pacific Coast. He stated that in this work the trucks using the magazine oiled suspension were allowed an increased rate per crate owing to the easier suspension, which prevented injury to the delicate berries.

There are other points on the chassis which should be lubricated in some way more closely, like the spring brackets, just described. These are such inaccessible points as the brake rocker mechanism, and so forth, which are seldom touched, but which would probably be lubricated more consistently were it necessary to renew the supply in the reservoir but once in 2 or 3 months.

Axles are generally good, according to Mr. Myers, but it would be well to look further into the matter of unsprung weight and see if more cannot be done in this respect. The paper concluded by pointing out that the time has now come to build for future development and permanent business. Mr. Myers cited the appeal for higher standards of quality voiced by an article by H. M. Swetland, president of the Class Journal Company, in an article in AUTOMOTIVE INDUSTRIES for January 23.

Keeping Army Trucks in Operation

Systematized maintenance in the army had reached a high state of development when the armistice was signed. This is made evident by the report given by Mr. Randles on keeping 40,000 army motor trucks in operation.

Obviously, keeping in repair 40,000 trucks, motorcycles, and any other motor equipment coming under the care of the Motor Transport Corps meant processing, standardization and quantity-production methods. The maintenance division of the corps adopted methods based on the experience of the foremost manufacturers of motor vehicles in the country. Motor experts were called on to give the results of their experience, and their advice adapted to that of army men who had observed motor transportation on the Mexican border. These men brought together the best practices, eliminated the faulty, and kept those that had stood the test. They picked the best standards and established definite limits to work to. Accuracy was adapted to production. A system of thorough inspection of every part was established and the final test made practically error-proof.

In the standardized repairshops the vehicle receives a complete rebuilding in all of its parts, including engine, transmission, body, upholstery, electrical apparatus, etc., and when finished, barring hidden flaws in some of the parts not replaced, it has at least the original capacity, and in many cases is capable of greater length of service than when new. The work, from the time the vehicle reaches the dead line until it passes through its process of rebuilding, is on the progressive system. In fact, in this plan modern manufacturing methods are applied to repair work, which results in low cost, large production, and the use of unskilled or specialized labor.

The schedule and routing department from the time a truck or other motor vehicle arrives in the storage yard, or "dead line" of a mechanical repairshop, keeps a record of it. As soon as it is assigned a position in the storage yard the arrival is noted in the production and schedule office and a record is made of the truck make, manufacturer's number, job number, and United States truck number. It is then surveyed and inspected by the survey board, which reports on the condition of the truck and recommends either rebuilding or salvage.

This report, approved by the shop commander, is the basis of the repair instructions. An identification memorandum is issued by the production department to the battery repairshop, advising that the truck is on the "dead line."

This shop removes the battery from the trucks, puts it in A-1 shape, holding it until the overhauled truck is ready for test. When the chassis-bay foreman has space for another job the production department assigns the truck to a vacant stall in the chassis bay. All these stalls are numbered consecutively, and the truck is tagged with its stall number.

A memorandum is then sent to all the departments, bearing truck made, manufacturer's number, job number, United States truck number and stall number. Every department then has full data on any unit which may come to it, identified only by its staff number.

As the various units are removed they are tagged with the stall number and placed on trailers in the center aisle of the bay. These trailers are picked up by tractors and taken to the distributing point in the main aisle, whence they are moved to their respective shops to be overhauled. The engine, transmission and driveshaft, rear axle, brake, front axle and steering column all go into the general overhaul and machine shop. Each part is tagged with a metal tag bearing the stall number. Parts coming from repair are inspected before being sent back to the stall. New parts are also inspected. After the engine, transmission and other units are put together in the sub-assembly and final assembly departments they are returned by trailer and tractor to the stall from which they originally came. The truck is put together again by the same gang that tore it down.

Organization of Division of Maintenance

The final test is thorough and intended to check repairs. It is given by a separate department and a group of men who had nothing to do with the actual repairing. The tested and approved truck goes back into service as good as new, and probably in better condition than 95 per cent of the trucks repaired in civil life.

The maintenance division of the Motor Transport Corps is organized for overhauling and rebuilding motor equipment in the United States and to supply parts, tools and personnel of mechanical repair units for overseas service. Maintenance repairs in the field are made by service park units which are mobile, or semi-mobile, and consist of 35 men with equipment. These units can be taken into the field, close behind the lines, where repairs can be made as the emergency demands.

Mechanical repairshops for overhauling in the United States are standard in size, eqquipment and personnel. Each is housed in a building of thoroughly modern, fireproof, concrete construction, so planned that considerable extensions can be made without disturbing the original floor arrangement. The original unit is 497 feet square, providing space to carry on 120 truck overhaul jobs at one time.

Within this enclosure is assembled equipment for completely rebuilding any style of motor vehicle. The men are so organized in all departments that the work is understudied all the way through; they are equipped with hand tool kits which are just as much a part of their equipment as a rifle is for an infantryman. The tool kits have been standardized for various classes of work and give each man the necessary tools for the job to which he is assigned and more or less confine his activities so that he will work as instructed.

Pneumatic Tires on Trucks

The most pertinent questions that arise in connection with determining the feasibility of the use of pneumatic tires are probably these:

(1) On what sizes of trucks can they be used?
(2) In what class of service?
(3) On what kinds of roads?
(4) What advantages are obtained?
(5) What disadvantages become evident?
(6) Will it be necessary to radically modify truck construction to use pneumatic tires most economically?

An analysis of data contained in AUTOMOTIVE INDUSTRIES, Jan. 16, 1919, shows that on trucks ranging from 1000 lb. to 5 tons' capacity the maker's equipment for tires is as given in the accompanying table:

Capacity Tons	No. of Models	Solid Only	Pneumatic Only	Optional
½	14	0	13	1
¾	18	3	14	1
1	64	41	8	15
1¼ to 1½	71	59	1	11
2 to 2½	128	118	2	8
3 to 3½	81	80	0	1
5	62	62	0	0

It must, of course, be recognized that this does not give an indication of the cars which have had their equipment changed by the owner after purchase, and probably does not give an indication of the cases where pneumatic equipment has been furnished at the customer's request. Conversely, if a sufficiently large demand had arisen, the manufacturer would undoubtedly have recognized the fact by listing as optional equipment.

The Field of the Pneumatic Tire

Viewing the figures with these facts in mind, it would seem to be safe to say that for vehicles up to 1500-lb. capacity pneumatic tires only are proper. From 2000 to 3000 lb. inclusive there is a strongly marked tendency toward pneumatics, and on 2- to 2½-ton trucks they are just making an appearance, while on the larger sizes there is practically no evidence apparent from this source. We have all seen large trucks of 3, 4 and possbly 5 tons' capacity with pneumatic equipment, and the fact that makers are not listing them would indicate that the proposition is still in the experimental stage.

The advantages claimed for the pneumatic tire are numerous. Some of these claims are so obviously correct as to need practically no discussion; others are open to considerable question. Also, as with every matter of this sort, the answer is not to be obtained from any one factor in the problem, but after the bearing which each factor has upon all the others has been given consideration.

The claims of advantage which are made may be listed as follows:

(1) Reduction in mechanical repairs.
(2) Increase in permissible speed.
(3) Decrease in gasoline consumption.
(4) Decrease in oil consumption.
(5) Less fatigue for men.
(6) Lessened depreciation of roads.
(7) Greater tractive ability.

The reduction of mechanical troubles can be accepted as a fact almost without comment. One point to be considered, however, is that while the net trouble is reduced, it is apt to change in character. With solid tire equipment, due to the shocks on the portions of the chassis which are not spring borne, the greater amount of difficulty is caused by the wear and looseness developed by this action. The small amount of resiliency in the wheels causes sharp blows to rack and twist the chassis structure, whereas the pneumatic tire absorbs a larger proportion of these shocks, and thus reinforces the spring action in relieving the chassis. There is, however, a reverse side to this, caused by the greater speeds which in spite of the generally larger sized wheels result in higher engine speeds. This sets up mechanical vibrations, which in conjunction with other trouble engendered by high engine speeds, raises the proportion of trouble in this part of the mechanism. However, as stated before, the total amount of trouble is decreased, and this becomes more apparent when placed in proportion with the car mileage.

Runs to test fuel economy were made with different loads; in the case of the solid tire one run was made with a considerable overload, which was not duplicated on the pneumatic tires. The results obtained are tabulated below:

Test No.	Weight Empty Lb.	Load Lb.	Total Weight Lb.	Ton Miles Per Gal.	Total Time in High Gear Per Cent
1*	4,500	525	5,025	30.33	89.1
2*	4,500	2,350	6,850	32.45	77.7
3*	4,500	4,175	8,675	36.35	62.7
4*	4,500	5,900	10.400	42.00	57.1
5†	4,500	680	5.180	28.20	81.3
6†	4,500	2,000	6,500	32.10	74.6
7†	4,500	3,580	8,080	31.96	62.1
8‡	4,500	550	5.050	24.40	88.2
9‡	4,500	3,480	7,980	27.40	63.0

*Solid tires.
†Pneumatic tires and the same axle reduction.
‡Pneumatic tires and a changed axle reduction to compensate for the greater wheel size.

The tests were made as carefully as possible and are, to say the least, disconcerting in the results shown. It is possible and, in fact, very probable, that these results are due to the form of the tires, which were not of the conventional cross-section and were designed to operate at considerably lower inflation pressures than normal.

General observations lead me to believe that the performance with regard to gasoline consumption will vary according to the road conditions. On very good roads there will be little or no difference, while on bumpy roads the pneumatic tire will show up the better.

Objections to Pneumatic Tires

The objections to pneumatic tires are not so numerous, but need careful consideration lest we be carried away with the idea that their use offers a solution for all troubles with no problems of their own needing attention. These objections are in my opinion:

(1) High initial cost compared with solid tires.
(2) The need of carrying emergency equipment.
(3) The difficulty attendant on making road changes due to weight and high inflation pressures required.
(4) Reduction of the high gear ability and limitation of the total ability due to larger diameter of wheels.
(5) Limitations imposed on the size of brakes due to the small size of wheels.

A material increase in tire mileage must be obtained to bring the cost per mile down to within a reasonable comparison with solid tires. Fortunately, this seems perfectly possible, at least up to 2 tons' capacity. On the group of cars which has been used before in this article for illustration, the grand average of reported mileage to date is 14,000 miles. One make of tire has averaged 19,000 miles, and of all the tires none has given less than 6000 or 7000 miles.

The weights are roughly as follows for an inflated tire and demountable rim: 38 by 7-in., 152 lb.; 40 by 8-in., 213 lb.; 44 by 10-in., 400 lb. These figures represent weights that require quite a bit of handling.

Inflation Pressures Recommended

Inflation pressures recommended are: 5-in. section, 80 lb.; 6-in., 90 lb.; 7-in., 100 lb.; 8-in., 110 lb.; 9-in., 120 lb.; 10-in., 130 lb., and 12-in., 140 lb. It is impracticable to consider hand pumping for any but the 5-in. size, and a mechanical pump to do the job is quite a piece of apparatus, and to be installed correctly adds another considerable item of expense which must be taken into consideration.

By referring to the table, it will be seen that the driving wheel diameters are increased as follows:

Capacity, Tons	Old Diameter In.	New Diameter In.	Increase in Diameter Per Cent
1	34	35	3
1¼ to 1½	34	36	6
2 to 2½	36	40	11
3 to 3½	36	44	22½
5	36	44	22½

On the smaller sizes the change is not so great and will probably work no material hardship except in cases where the brake equipment is on the transmission. With the larger sizes the difference is so great as to make it extremely doubtful whether there is sufficient flexibility in any well-designed truck to permit successful application.

Capacity, Tons	Solid Front, In.	Solid Rear, In.	Pneumatic Front, In.	Pneumatic Rear, In.	Increased Cost Pneumatic Over Solid, Per Cent	Increased Cost Pneumatic Over Solid, Including Extra Tires, Per Cent
1	34×3½	34×4	35×5	35×5	80	125
1¼ to 1½	34×3½	34×5	35×5	36×6	93	184
1¼ to 1½	36×3½	36×5	35×5	36×6	77	165
2 to 2½	36×4	36×7	36×6	40×8	110	216
3 to 3½	36×5	36×5 dual	36×6	44×10	87	180
5	36×6	36×6 dual	38×7	44×10	60	140

N.A.C.C. Truck Convention A Success

Few Surplus War Trucks in America—Prospects Not Bright for Exports to Europe—Truck Registration by Speed and Weight—More Standardization Needed—Standard Warranty Needs Revising

NEW YORK, Feb. 11—Representatives of over seventy-five motor truck makers attended the truck convention held to-day by the National Automobile Chamber of Commerce, the convention being one of the best held in some time by the chamber. Subjects relating to increased use of motor trucks and improved systems of handling them were discussed. The convention covered a wide range of subjects and turned the meeting into a kind of house-cleaning day on many matters relating to trucks.

A new system of registering motor trucks on a basis of speed and weight was recommended by George H. Graham. A similar system was recommended for all horse vehicles.

Col. Fred Glover intimated that there will be very few surplus war trucks and that most of our war trucks in Europe will be disposed of on the other side of the Atlantic.

The complete elimination of the truck warranty by manufacturers and the sale of trucks on their merits and reputation was recommended by E. J. Herbig.

David Beecroft in reviewing possiblities of foreign trade in trucks showed that prospects are not bright for such trade at present due to the large surplus of war trucks owned by our Allies.

David C. Fenner asked for standardization of more truck parts and emphasized the necessity of such in throttle and spark levers as well as with gearshift and brake levers.

E. J. Mehren favored a federal system of highways to supplement state systems and the necessity of a great educational campaign on highway improvement and the better use of highways.

James I. Blakslee advocated a better national system of transportation by closer correlation of the post office, the highways and the motor truck.

A committee of truck men was appointed to discuss with a committee of the tire makers what truck tire sizes should be eliminated.

Few War Trucks for Sale

Col. Fred Glover of the Quartermaster's Department U. S. Army, in discussing the probability of disposing of any surplus war trucks which might be on hand after the determination of the size of the U. S. A. standing army in this country, was of the opinion that none of the U. S. A. war trucks now abroad would ever be returned to this country but would be sold abroad, together with the large stock of spares for such vehicles already shipped overseas.

In answer to a question as to whether the public auction of 325 trucks owned by the United States Spruce Production Corps in Portland, Ore., on Feb. 15 is an indication of the government's policy regarding the disposition of surplus trucks, he stated that the War Department had no jurisdiction over the trucks being auctioned off in Portland. Those vehicles were under the direct supervision of the Spruce Corps and not of the War Department.

He expressed it as his opinion that the various government departments would consume a large number of the motor trucks now on hand. No definite statement as to the possible number of such surplus trucks can be made at this time on account of the impossibility of knowing the needs of our army of occupation abroad and of our standing army at home.

There are fewer than 100 motor trucks owned by foreign governments now in this country which might be auctioned off. It is the intention of the government to cause the least possible disarrangement of the truck industry, and that all of the military trucks would be consumed by the various governmental departments if these had sufficient work for them to do.

There are enough spare parts on hand for these vehicles to prevent breaking up any second hand trucks to repair others of the same make and capacity.

S. M. Williams, president of the Highways Industries Association, brought out the fact that the Post Office bill which passed the Senate last week provides that any surplus military trucks be turned over to the various states for road building work and that the state governments pay for these vehicles in the same ratio as they share in the construction of federal aid highways. A large number of truck makers had objected to this plan on the ground that such disposition of surplus war trucks would cut off a possible market for new trucks. Colonel Glover stated that the motor truck industry could not expect to get back to a peace basis without some readjustment to make up for the large number of military trucks sold during the war.

A National Highway System

That a successful system of national highways must be built, laid out and maintained exclusively by federal funds; that the maintenance and control of such a system of highways must be vested in a Highway Commission and not in an obscure office of a governmental department, and that a great educational campaign must be conducted to convince 100,000,000 people of the new development in highway transportation were the three cardinal topics discussed by Edward J. Mehren, representative of the Highways Industries Association.

The various states cannot be expected to spend their highway appropriations except for the greatest benefit of those states. The national system of highways would have to be built with the view to serving the country as a whole irrespective of the economic advantages of such a route to the particular states which it crossed. He emphasized the fact that the national system should be carried on in addition to the federal aid road construction and that these latter roads would act as feeders to the main truck line. He further urged the increased use of federal aid funds as an incentive to the establishment of competent highway departments or commissions in those states which are now backward in road development.

A Federal Highway Commission, according to Mr. Mehren, is the only logical manner of supervising the building of a national system of roadways, since the various states could not be expected to maintain such a road to the same degree as would be the case if the government had the work in charge.

Highway transportation has developed more in the last 10

years than the railroads did from 1830 to 1880, a period of 50 years. The great majority of the present voters were brought up under conditions which existed before the beginning of this new era of highway transportation by motor vehicles and must be educated along new lines before the realization of the great road building program can be accomplished.

Register by Speed and Weight

A new method of state registration of motor trucks based on speed and weight was advocated by George H. Graham, chairman of the Motor Truck Committee of the N. A. C. C. and presiding officer at the convention. There should be some fundamental systems of registration and the two cardinal principles in such a system are speed and weight. The suggested method of determining trucks license fees based on speed and weight would eliminate the present discrepancies which vary from $5 to $125 for a truck of the same speed and capacity in various states. Connecticut has the $125 fee for a 5-ton truck and Massachusetts has $25 for a similar truck. Other states further west have a $5 fee for the same capacity vehicle. No action of the convention was taken on the suggestion.

The proposed rates for pneumatic tired trucks was 25 cents per horsepower plus 25 cents per 100 lb. of the gross weight of the truck and load.

For trucks with two or more solid tires the corresponding rates would be 25 and 35 cents.

For trucks with iron or steel tires the rates would be 25 and 50 cents.

Horse vehicles should pay their share of taxation for road maintenance by a tax of $3 for wagons under 1000 lb. capacity, and for wagons over 1000 lb. $3 plus 50 cents additional for every 100 lb. above the 1000 lb. limit.

Small Export Trade

The possibility of truck export trade with Europe, analyzed by David Beecroft, Directing Editor of AUTOMOTIVE INDUSTRIES, who has recently returned from a three-month investigation of conditions in Europe, showed that prospects are not specially bright at present, due to the large war production of England, Italy and France and the number of new and used war trucks that will be turned back into industry as soon as peace is finally settled.

The British manufacturers are much perplexed over this situation. To-day there is no such thing as exporting trucks to Great Britain because the order of total restriction against imports is in force and is likely to remain in force for some time to come.

There are in England 20,000 new war trucks that can be turned into the channels of industry. In addition there are available nearly 50,000 used war trucks, most of which will be repaired or rebuilt before being put into industry. Added to this are 10,000 ambulances not needed in the war work and 12,000 light delivery vehicles, which give a grand total of nearly 90,000 vehicles.

The truck production of Great Britain for 1919 has been estimated at 20,000 trucks of all capacities, so that in view of this figure the magnitude of the war trucks that can be returned to industry becomes apparent.

The production of British truck companies varies from the largest factory with a capacity of 125 trucks per week to others having a capacity of but a few. There are, among the leading makers, two with a capacity of 25 per week each, and others with capacities of 18, seven, six, five and four per week.

Italy had a very large production of trucks during the war, Fiat alone selling upwards of 50,000 to the Allies. Fiat's maximum production reached 170 per day and for months its production approached 75 per day. In Italy such other firms as Spa and Lancia have been building trucks in quantities during the war. France, England and America purchased large quantities of Fiat trucks.

Great Britain has passed a bill appropriating $130,000,000 for road improvement, which augurs well for an increased use of motor trucks. It will be impossible to expend this sum in a year, but it will be expended as rapidly as possible.

There has been a big increase in electric trucks in London during the war due to the scarcity of gasoline and the cheapness of electric current. Before the war there were 250 electrics in London and now there are 2000. The manufacture of electric trucks is being started in England by one firm that aims at an early capacity of 60 vehicles per month.

The use of steam trucks has increased very largely in England, partly due to the adoption of solid rubber tires on these in 1915. Now the steam trucks burning coal travel as rapidly through the streets of London as gasoline types. In the war zone are hundreds of steam trucks used in road building and salvaging. The use of coke as a truck fuel has been under development of late. The fuel cost for steam truck approximates 50 per cent of the cost of gasoline types.

Urge Elimination of Truck Warranty

Entire elimination of the standard warranty covering material and workmanship in trucks was recommended by E. J. Herbig, sales manager of the Service Motor Truck Co. The warranty was necessary in the early days of the industry but not to-day with the developed trucks. To-day the standard warranty is really an indication that something is going to happen to the truck.

This view was concurred in by David S. Ludlum, president of the Autocar Co. It is not expected that any such radical action will be taken, but Mr. Herbig recommended an immediate revision of the warranty in order to make it more considerate of the owner and yet not work any sacrifice on the maker.

The warranty should cover tires and truck equipment. The warranty should be rewritten to cover trucks specifically, and since the governor is such a factor in truck operation it should be written into the warranty that tampering with the governor and operating the truck without the governor cancels the warranty.

In handling spare parts Mr. Herbig had some suggestions to offer the truck maker, such as: The dealer should have the opportunity of returning obsolete parts within one year and should be paid the price for them that he originally paid the factory. The dealer should be required to carry a stock of spares sufficient to take care of the trucks in the territory. In returning defective parts the dealer should tag them showing the name of the truck owner, serial number of the truck and date of the fracture. Dealers should be given discounts on spares in accordance as they carry adequate supplies for the trucks in use. There should be a better standardization of the names of truck parts so as to avoid confusion that follows where dealers use different names for the same parts.

In connection with the standard service policy for trucks it was recommended that the dealer be impressed with the evil of idle trucks due to any cause. An idle truck is the poorest kind of advertisement.

More Standardization Needed

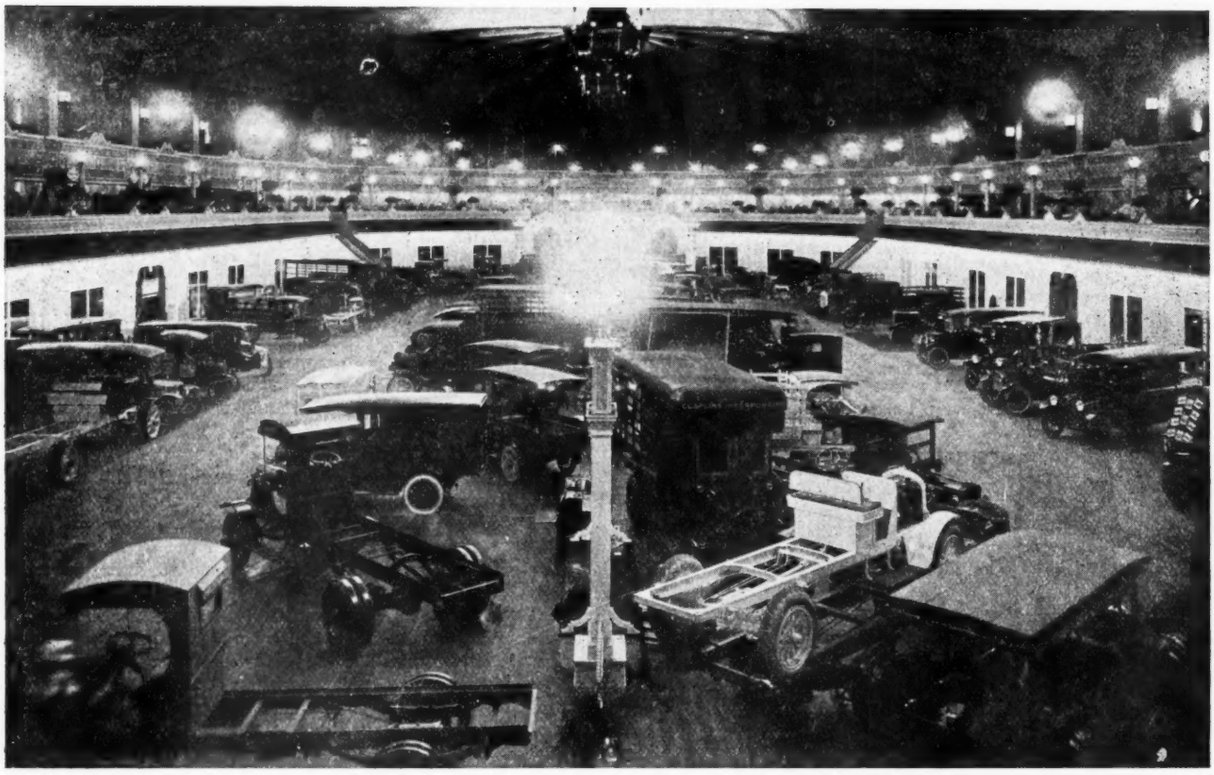
That truck manufacturers have never given sufficient consideration to standardizing the position and manipulation of spark, throttle, gearshift and emergency brake levers is the opinion of David C. Fenner of the International Motor Co.

A standard gate or location of the gearshift positions in relation to the driver's seat is highly important. If the S. A. E. standards which already apply to these features are not commercial, manufacturers should apply for a revision. If, on the other hand, these are among the details of motor truck design which are quite likely to be changed by further development, it would not seem wise to attempt their standardization at present.

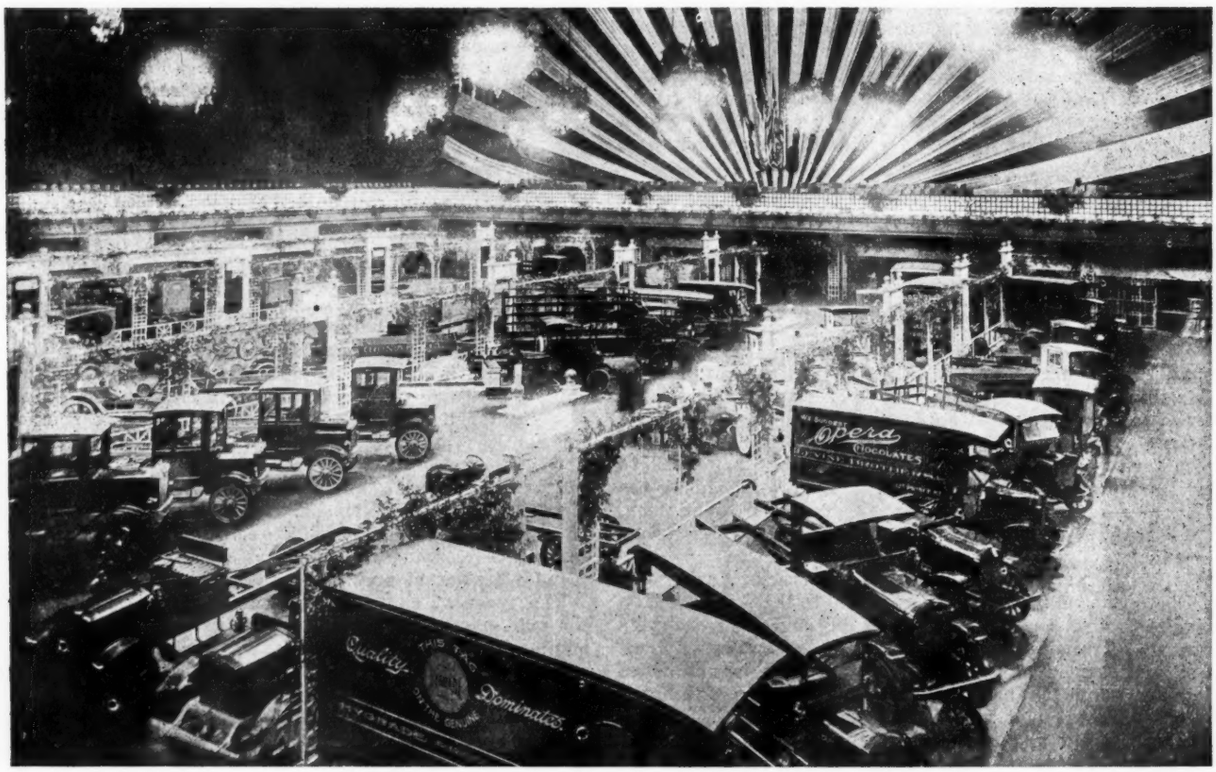
The types of chassis standardized for army work during the war emergency contain details of design selected by the engineers, who volunteered for this work, as representing the average practice of the times with the extraordinary requirements of army service kept constantly in mind.

The fact that these engineers considered it necessary to develop special types for army work does not necessarily indicate that these types will prove practical and economical for average commercial service, and as this is the problem of the immediate future, it is the basis on which we must consider the advisability of further standardization.

Two Views of the New York Motor Truck Show



Madison Square Garden with its exhibit spaces filled with commercial vehicles for the second week of the show



View of the 69th Regiment Armory part of the Commercial Vehicle show

Engineering Refinement Evident at Truck Show

Better Driver Protection—Oil Chassis Lubrication—Pneumatics for Lighter Types Among Developments

NEW YORK, Feb. 10—The motor truck show, which opened here to-day at Madison Square Garden and the 69th Regiment Armory, has 144 vehicles on the floor, some of which are new models and 22 of which were not shown at Chicago. The trucks show a refinement of detail which parallels what has been found in the passenger car industry. There is little or nothing of a radical nature, but minor refinements are plentiful, particularly as regards chassis lubrication and in the better protection of the driver.

Tractors Shown for First Time

Tractors were on the floor for the first time at a New York show. Four makes were represented, Fordson, Maxim, National and Emerson-Brantingham. These attracted such a great amount of interest that doubtless the farm tractor is going to be present at future truck exhibitions. There was no attempt made to segregate the tractors and make a tractor section of the exhibit, but these were put along with the motor trucks.

In a great number of exhibits, special bodies were shown, which made it apparent that one of the effects of the war and the experiences in the Motor Transport and other corps is to produce bodies which are more carefully designed for the specific task they have to perform. The bodies are of all styles, even including the public service type, such as a pay-as-you-enter bus, fire-engine, ambulances, hearses, and so forth, and there are also a number of new designs of convertible side stake and side panel types. One of these has interior shelving for assisting in efficiently handling small package work.

Five Makes of Converters

There are five makes of converters for turning passenger cars into trucks, and three makes of trailers. A number of the accessory makers retained their booths from the passenger car show, but altered materially the nature of the product contained in them so as to make them directly applicable to trucks.

There are a few new models on the floor, such as the Fulton 3 to 4-ton tractor and trailer, a new 1-ton Columbia, a new 5-ton Acme and a 2-ton Shaw. The new 3-ton Rowe is one of the up-to-date higher speed types, being capable of running at 30 m.p.h., and is mounted on pneumatic tires. It is equipped with a Herschell-Spillman eight-cylinder engine, and the rear axle is worm driven. The newer makes are all assembled types and a number of them use the Continental truck motor, this being evidenced by its employment in the Columbia, Acme, Shaw and other types which have not been previously exhibited.

One could not fail to be impressed with the fact that the use of pneumatic tires is increasing rapidly in the lighter capacity vehicles. Up to 2½ tons this is a matter of common usage, and it is even predicted by some of those exhibiting that the utilization of pneumatics for even heavier capacities is going to come in on a larger scale than was expected. This has come about very largely through the demand for higher speed in connection with long haul work. It is necessary to maintain a good average rate if long distance truck haulage is to be made a paying proposition, and the use of pneumatics is counted on to make high speeds possible without undue strain on the vehicle. This is an important consideration at the present time, when maintenance of roads and conservation of fuel are in everyone's mind.

Oil lubrication has supplanted grease on a great many of the trucks, the new Columbia, for instance, having entirely gone over to oil for all the chassis bearings. It is a noticeable feature that many of the manufacturers of trucks, in the same way as those who make passenger cars, seem to believe that it is necessary to make the oil cup as large as the grease cup which it replaces.

This is not only untrue, but it is positively harmful, because the larger oilers more readily admit dirt and water than the smaller type. It is always necessary to fill oil cups anyway, as they are not able, as a rule, to retain the lubricant, nor to act as a reservoir. Therefore, unless some reservoir system is used at the bearing, a few drops injected into a small oil opening is just as satisfactory as an over-supply in a cup which is too large.

Heavy Radiators the Rule

It is noticeable that many of our trucks are very heavily loaded over the front axle. The cause of this is a heavier radiator than perhaps could be constructed if particular attention were paid to the lightness of this unit. None of the radiators on the trucks seem to be designed on the basis of lightness, but it is very well possible that a reduction in weight at this particular point might make steering easier and lighten the stresses on the steering parts.

Better cushions, deeper springs under the seats, more enclosed cab protection and improved control layout are among the features which are found in the new trucks. This attention to the comfort of the driver is recognized as contributing materially to the possibility of securing better performance from the truck. In other words, a tired driver is not a good driver. He cannot take care of the vehicle in his charge if he is weary, due to the handling of badly laid out controls and uncomfortable from his exposure to the elements.

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ACCORDING to the Government reports, the exports of tungsten ore from the Federated Malay States for the year 1917 amounted to 761.31 long tons, as against 515.47 tons in 1916. In 1913 the production of tungsten ore in these States was only 225.06 tons, so that the output has more than trebled since the outbreak of the war. The export figures for 1917 do not accurately represent the production of tungsten ore, some of the ore included in the above figures having been sent to the Federated Malay States for treatment and re-exported.

FUEL

HOW CAN CRUDE OUTPUT BE INCREASED? HOW CAN WE INCREASE THE GASOLINE YIELD?

Greater Co-operation Between Refiner and Automotive Engineer Needed—Mexican Oil May Not Be as Plentiful or as Useful as Generally Thought—Three Possible Substitute Fuels Are Benzol, Alcohol and Shale Distillate

Improved Design of Automotive Apparatus Can Have Important Bearing on Future Consumption of Fuel—Crankcase Dilution Serious

ONE of the most vital phases of the winter meeting of the Society of Automotive Engineers, held in New York, was the discussion of the fuel situation. The lesson derived from the meeting is that the time has arrived for co-operation between the refining and automotive manufacturing industries. We are now drawing on our reserve stock of crude petroleum and the curve of consumption has crossed the curve of production. With this condition, predictions are freely made by petroleum experts that gasoline prices are due for a sharp rise unless present conditions, either as regards fuel or consumption, are changed.

From the papers presented by Joseph E. Pogue of the United States Fuel Administration, who gave an interpretation of the engine-fuel situation, and Dr. E. W. Dean of the Bureau of Mines, who spoke on sidelights on oil refinery practice, it was quite evident that new petroleum discoveries and new distillation methods, while augmenting our supply, are not keeping pace with the increase in demand due to the more extended use of automotive apparatus.

It was pointed out by the authors of these papers that the matter is not solely one for the petroleum expert to solve. The low thermal efficiency of the internal combustion engine is one of the greatest causes for the excessive use of fuel. Automobile engines operating under very small throttle openings, as a rule, are not more than 8 to 10 per cent thermally efficient. In other words, from 8 to 10 cents' worth of propulsion is secured for a dollar's worth of fuel. If the thermal efficiency could be materially raised the available supply of fuel would go a long way further.

At the present time we are getting about 20 per cent gasoline from crude. This factor, like the supply of crude petroleum, is a variable figure and is directly dependent upon the sort of crude and the methods used in distillation.

As yet, the cracking methods have only been of minor assistance, but scientists are optimistic regarding the possibility of further increasing the output by extending the cracking processes and making them available for cracking not only the more volatile of the fuel oils, but also in handling the kerosene content.

The papers presented on the Mexican field showed that while there is a considerable supply of fuel to be obtained from this source, the mythical tales of fabulous deposits of petroleum do not seem to have any real basis in fact. There are many difficulties in the way of using any great quantity of the Mexican crude for some time to come, and it is very probable, according to Mr. Pogue, that the Mexican supply may be very largely utilized in taking care of the needs of the merchant marine and navy of Great Britain and the United States.

Very little discussion took place on the fuel situation among the members of the Society. This was due to the length of the program, which precluded the possibility of any extensive discussion.

Regarding the substitute fuels it was pointed out that there are only three which at the present time have any importance at all. These are benzol, alcohol and shale oil distillate. Benzol can be sold at a competitive price with gasoline, but it cannot be produced in quantities sufficient to be a material factor in the situation. Alcohol and shale oil can-

not, under the present circumstances, be made to sell at the price now obtained for gasoline. For this reason there has been no great stimulant to the development of the two latter products, although much development work has been done.

In surveying the fuel situation one is impressed by the big factor in fuel conservation that improved design is going to become. The higher thermal efficiency secured in aircraft engines has shown that there are possibilities along this line which have never, so far as known, been reached in automobile or truck practice.

Now that the tractor field is about to open up on a very large scale and since the tractor is going to be a heavy consumer of fuel, due to the fact that it is operating under heavy load conditions at all times, the matter of engine design becomes of the highest importance.

The descending volatility is increasing crankcase dilution to a marked extent, making it necessary to frequently renew the lubricating oils, thus adding to the expense of operation. Co-operation between the engineer and the refiner is necessary to solve these problems.

An Interpretation of the Engine-Fuel Situation

By Joseph E. Pogue

U. S. Fuel Administration

THE principal factors in the engine-fuel situation are the demand for liquid fuel and the adaptability of the internal-combustion engine, on the one hand, and the supply of crude petroleum, the gasoline-producing capacity of this material, and the substitute fuels in sight, on the other. Out of the interplay of these factors will come developments, focussed in the price of engine fuel, that will determine the future of the automotive industry.[1]

The Demand for Motor Fuel

The demand for engine fuel has been increasing over the past few years at an imposing rate. The nature of this expansion is shown graphically in Fig. 1. The construction program of automotive manufacturers, moreover, affords no prospect of let-up in the pressure of fuel requirement; on the contrary, the injection into the situation of a notable development in the capacity for truck production introduces an element that bids fair to overshadow even the tremendous automobile demand, while the item of tractor manufacture looms ahead with a fuel significance scarcely second in importance. If these matters be projected into the future unabated, it is evident that the supply of engine fuel will need to be doubled every few years. The automotive industry is young and vigorous, and its continued expansion will place an unexampled burden upon the engine-fuel resources of the country.

Adaptability of Motor Type

The automotive engine has developed and become standardized in its main features on the basis of cheap and volatile gasoline. Its improvement has for the most part followed the direction of convenience and performance, with secondary consideration to fuel economy. This trend has been sustained to the present time by the existence of a highly stimulated oil production, providing gasoline capacity in excess of gasoline demand. So long as this condition obtained there was no need for the automotive industry to concern itself with considerations of fuel supply, but now, with the gasoline capacity of the country beginning to give indications of strain, while the gasoline demand is just fairly getting launched, the question arises whether the exigencies of the future will allow the engine type continued freedom of development in luxury directions, or will force adaptations to meet the exactions of the fuel situation.

Automotive apparatus is mechanically responsive to changing requirements, but its adaptation to new conditions is retarded by the time required to perfect mechanical developments and the counter advantage to be gained from quantity production and standardization, with their antagonism to change. So far-reaching and insistent, indeed, are the claims in favor of holding fast to established standards that departures can be made only at great cost and in response to powerful reasons. Anticipatory action becomes peculiarly difficult in the face of these circumstances. Recognizing the strength of the opposition to changes in engine-type and seeking to force the fuel supply into channels fitting the established standards, we may examine the fuel supply with a view to determining if present engine standards can be advantageously maintained, and, if not, along what lines changes are likely to be made.

Supply of Engine Fuel

The engine fuel in dominant use in the United States is gasoline, a mixture of volatile liquids won from crude pe-

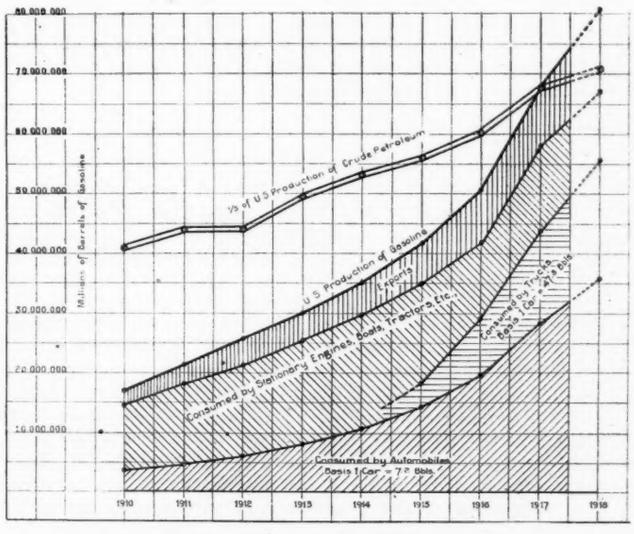


Fig. 1—The gasoline situation

This composite chart is drawn from data as follows: Crude production from U. S. Geological Survey; gasoline production from U. S. Fuel Administration and U. S. Bureau of Mines; automobile and truck consumption based on registration compiled by National Automobile Chamber of Commerce, and consumption factors worked out by War Industries Board (see manuscript report by M. J. Gillen on Regulation of Uses of Motor Cars, Gasoline, Rubber Tires and Rubber, Nov. 4, 1918). This chart is not exact in final detail, but is an interpretation of data approximately correct.

[1]The validity of the conclusions presented in this paper depends upon the correctness of the writer's diagnosis in respect to four basic points: The domestic supply of crude petroleum, the significance of Mexican petroleum, the significance of cracking, and the adaptability of the automotive apparatus. An independent check upon these points, which will serve to substantiate, modify or controvert the present argument, will be afforded by the other papers presented at the Fuel Session of the Annual Meeting of the Society, as well as by a study of the references given at the end of the paper.

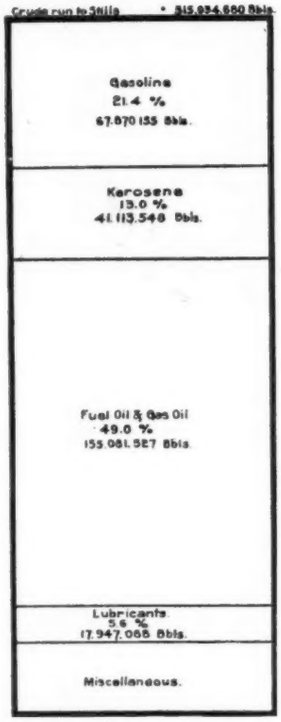


Fig. 2—Gasoline and its joint products. Data from U. S. Fuel Administration

troleum by a process of distillation.[2] Kerosene, fuel oil, lubricants and various by-products are produced at the same time, and bear an intimate relation to gasoline, both as to production and price. The relative output of these products in 1917 is shown in Fig. 2. The quantity of gasoline that the country is capable of producing depends upon the supply of crude petroleum and the gasoline capacity of this material.

Supply of Crude Petroleum

The supply of crude petroleum for years to come depends upon the unmined reserve and the rate at which it may be won. The reserve in the United States was inventoried by the U. S. Geological Survey in 1908, in 1915, and again in 1918, with results shown in Fig. 3. The significant aspects of the results are two: The small size of the reserve, approximating 6,000,000,000 bbl. in 1918 (our annual production is over one-third billion), and the fact that in the past ten years, in spite of an exceedingly aggressive campaign of oil exploration, the decrease in the reserve has exceeded the addition to the reserve through new discoveries. Those, therefore, who count upon new discoveries to materially affect the basic situation overlook the fact that for ten years already discoveries have been failing to do so.

At the same time the production of crude petroleum has been steadily mounting to its present enormous figure. This growth in output, shown in Fig. 3, has been sustained, not primarily by the discovery of new oil fields, but largely by the cumulative tapping of an increasing number of rich spots in inventoried territory. There is obviously a limit to an output supported by such a train of circumstances; there are strong engineering and economic reasons for believing that the output of crude petroleum in the United States is nearing its maximum and that the country will soon pass into a period of slowing and more costly production.

Gasoline Factor

The output of gasoline approximates[3] the supply of crude petroleum multiplied by its commercial gasoline factor,[4] which at the present time is about 20 per cent. This factor, like the supply of crude petroleum, is itself a variable figure depending upon the proportion of the crude supply subjected to refining, the natural gasoline content of this quantity, and the extent to which means are used for forcing the gasoline yield above the natural gasoline content. Obviously, so long as the natural gasoline is not fully extracted from the available crude, there is scant economic room for the development of roundabout, i.e., more intricate, more costly means for producing gasoline. This was the situation that prevailed in the United States until recently; this is why natural-gas gasoline, cracked gasoline and low-volatile gasoline are all recent commercial developments.

The proportion of the crude supply subjected to refining in respect to gasoline has been steadily increasing until the quantity so employed now approximates 95 per cent of the total.[5] Thus practically the whole output has now come to be requisitioned for gasoline production. This is to say that the readiest means for increasing the supply of gasoline, i.e., refining a progressively larger percentage of the crude produced, has been virtually forced to its limit; the "gasoline slack" within the crude production has been taken up. Thus the most potent circumstance that has thus far enabled the demand for gasoline to increase without a concomitant increase in price is no longer in existence (see Fig. 1). Further expansion in gasoline output will lie through a more difficult avenue than that of merely increasing refinery capacity.

Gasoline Content of Crude Varies Widely

While dependent primarily upon the quantity of crude refined, the output of gasoline is at the same time a function of the average composition of the various crudes that go to make up the total supply. Since crude petroleum varies in its natural-gasoline content[6] from about 2½ per cent in the case of heavy asphaltic oils to 25 per cent or so for light paraffine oils, it is evident that the gasoline supply will be strongly influenced according to the dominance of the one or other type of oil. As the high-gasoline crudes were the first to be exploited in this country, the unmined supply of petroleum has been selectively reduced in gasoline capacity,[7] so that the crude production of the future will show a lower natural-gasoline factor than the crude supply of the past. While this matter cannot be expressed quantitatively, in very rough terms it may be noted that the high-gasoline crudes are about half exhausted, while the low-gasoline crudes, originally of about equal magnitude, are only about a third used up. In other words, the country's gasoline capacity is being drawn upon more rapidly, and hence exhausted more quickly, than is indicated by the condition of the crude supply viewed alone. This tendency was of no immediate consequence so long as it could be compensated by merely refining a greater proportion of the output of crude; but now, since practically all of the domestic crude is used for gasoline extraction, a decline in gasoline content can be offset only by shoving crude production to a higher figure than would otherwise be necessary, or else through a still greater use of means for wresting an unnatural percentage of gasoline from the crude obtainable.

Means of Increasing Yield of Gasoline

The means for producing more gasoline than may be obtained by subjecting the total supply of crude to straight refining are: (1) increasing refinery efficiency, (2) blending high-volatile natural-gas gasoline with low-volatile refinery gasoline, (3) increasing the use of cracking in refinery practice, and (4) lowering the volatility of gasoline. All four means are increasingly in use. For the sake of brevity, the first two may be passed over with the comment that, while important, they have quantitative limitations which prevent them from broadly affecting the situation. This is not true of the second two, the limitations of which are of a different order.

Cracking is a process attachable to straight refining, by means of which low-priced distillates such as kerosene and fuel oil are re-run under more rigorous conditions and partly converted into gasoline. Obviously, cracked gasoline costs more to produce than natural gasoline, because of a greater consumption of capital, labor, material and fuel, and is commercially possible only after gasoline requirements have approached the quantity produceable by straight refining, and as long as there is a certain difference in market value between the raw materials used and the product turned out. The first condition has recently been attained, and there is already economic room for cracking; the second condition, if the prices of kerosene and fuel oil rise, can be maintained

[2] A small proportion of the supply is extracted from natural gas, but this does not largely affect the general situation.

[3] Because of the subordinate item of gasoline produced from natural gas, the relation is not an exact equality.

[4] The commercial gasoline factor is here used to represent the percentage of gasoline obtained from the crude consumed; the natural gasoline factor is the percentage of gasoline contained in the crude consumed. The first has increased until it has overtaken the second. (See Fig. 1.) The terms are used in a general sense.

[5] A much smaller proportion, of course, is subjected to complete refining with the production of the whole range of petroleum products.

[6] This term is used in a practical, rather than a strictly scientific, sense.

[7] The gasoline content of crude oil has been known to decrease even during the life of a given pool, which is a tendency in the same direction as that occasioned by selective extraction in respect to separate pools and fields.

only by a proportionate increase in the price of gasoline. The prospective growth in the use of the Diesel engine, especially for marine service, with its high fuel economy in the consumption of heavy petroleum distillates, may be expected to lessen the advantage that at the present moment accrues to cracking. Although the price of fuel oil is limited by the price of coal, the advantages of oil over coal for marine service are so marked that fuel oil can probably rise to $5 to $10 per bbl. before reaching its limit. Another no less potent factor bearing unfavorably upon the aid that the automotive industry may expect from cracking is the circumstance that the cost of cracking becomes greater as the percentage of gasoline demanded of a given quantity of raw material increases. This means, so to speak, that a little cracking may spread rather rapidly to all the crude refined, but much cracking will involve a step-up to a higher level of costs. In addition, the retarding influence that private control of patents will exert upon a widespread use of cracking processes should not be left out of account. Opposed to these unfavorable economic aspects of cracking, which offer relief only upon a basis of higher prices, is the matter of advance in cracking technology toward increased efficiency and lowered costs. Progress of this kind is undoubtedly in store, but advances under this head must work within the broad economic restrictions laid down above, and can scarcely be counted on to more than temper the price advances competent to maintain the requisite increase in cracking output. On the whole, then, there are reasons to believe that cracking, while of great importance at present, will under expanding use develop toxic properties, so to speak, which will limit its field of operations, if not ultimately remove it largely from the scene of action.

Lowering the Volatility

The fourth means for enlarging the output of gasoline independently of the production of crude is through lowering the volatility of the product. The less specialized the engine fuel in respect to volatility, the more can be produced from a given quantity of crude by the processes of refining in general use (see Fig. 2). By a change in character, the supply of "gasoline" can be enlarged, slowly or rapidly at will, without material refinery changes, until it is two to three times the present figure, even with no increase in the output of crude. Since the materials requisitioned in such a change are the basis of kerosene and fuel oil, which can be replaced almost entirely by coal and its products, the transition may be made without a basic disturbance of the country's economic fabric and without setting up counter forces tending to turn back the tide, as would be the case in an over-dependence upon cracking. The practical limit to this enlargement, however, is set by what the standardized automotive engine will accept in the way of fuel; which is to say that this avenue of advance is wholly in the hands of the automotive industry. The progress of gasoline in this direction has already gone about as far as practicable under existing standards of mechanical equipment; if the fuel current finds an unbreakable dam at this point, the whole pressure of advance will be thrown back into the channels already reviewed. Inasmuch, however, as the past few years have seen the volatility of gasoline steadily decreasing, in spite of laws and the desires of the automotive industry and the public to the contrary, while engine design has already been forced to respond to this circumstance with superficial adaptations, it is apparent that the channels of crude production, cracking, etc., have already demonstrated their incapacity unaided to accommodate the rising flood of gasoline demand. If these mainstays of the automotive industry are failing to meet the issue now, it is hazardous to count upon complete relief in this quarter when the pressure focussing there is rapidly increasing.

We have seen, so far as the petroleum situation in the United States is concerned, that an increasing supply of gasoline of present grade can be maintained into the future only through a growing use of cracking processes, involving material increases in the cost of production. But there are large oil deposits in Mexico which are believed by many to be capable of sustaining a North American supply of crude sufficient for all demands, even in the face of a slowing domestic output. What bearing does this factor have upon the engine fuel situation?

The Bearing of Mexico Upon the Situation

The oil-producing capacity of Mexico is certainly great, but the size of the underground reserve that will have to sustain production is largely an unknown quantity. The geological occurrence of Mexican petroleum is widely different from that of oil in the United States, and is of such a nature that the unmined supply cannot be readily inventoried. The output of Mexico to date has come largely from two wells of prodigious capacity, which have been held in check, but one of these wells is recently reported to have gone to salt water. There are, in addition, political difficulties in the way of the exploitation of Mexican petroleum, because of which the output will have to go in part to Great Britain, whose subjects hold extensive interests in the Mexican fields, and to other foreign countries. Mexican deposits are also involved in a large and growing fuel-oil demand in respect to the merchant marines and navies of Great Britain and the United States, which alone will tend to exhaust them rapidly.

Of even greater significance to the engine-fuel situation, however, than the quantity of crude that Mexico may be expected to contribute to the domestic supply, is the natural gasoline factor of this contribution. Unfortunately the natural gasoline content of Mexican petroleum is low, so that the more the domestic supply of crude is supplemented by imports from Mexico, the more the natural-gasoline factor of the entire crude supply is reduced, the more must cracking methods be called upon to sustain the production of gasoline. Thus, not only is the future of Mexican production a subject upon which adequate information is wanting, but, with the most optimistic assumption in that respect, the character of the supply is such as to be capable of sustaining an output of gasoline only upon a higher level of production costs[8] than now prevails. Thus Mexico, instead of offer-

[8]This may not be strictly true of gasoline produced in Mexico itself as a by-product of fuel oil for a period following the establishment of large "topping plants" and in event of sustained production in that country of crudes containing appreciable quantities of gasoline; but imported gasoline can scarcely be counted on in quantities large enough, or sufficiently soon, to materially affect the situation in the United States.

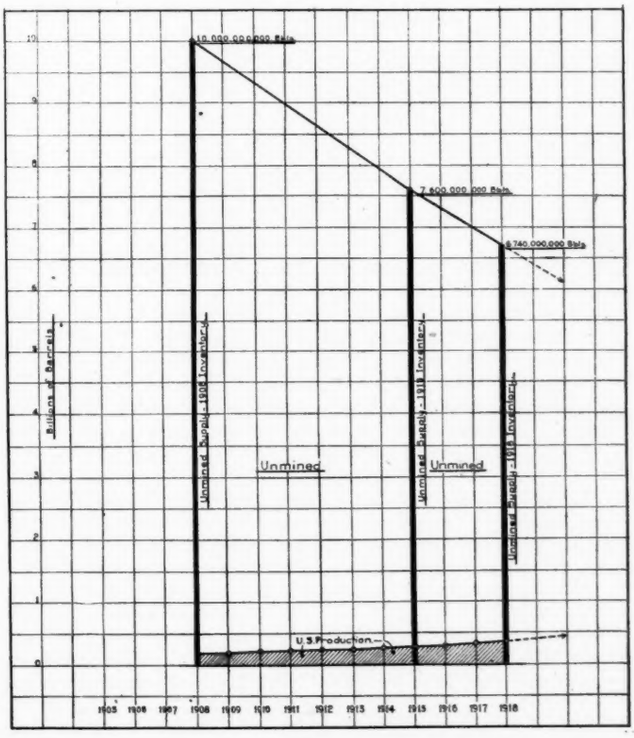


Fig. 3—The domestic crude petroleum situation. Data from U. S. Geological Survey

ing a solution to the engine-fuel problem, promises only to accentuate the issue, especially as the sudden leap in production that is impending from this source will lend a strong color of assurance to the situation.

The statements thus far made in respect to Mexico may, without substantial qualification, be extended to include the oil fields of Central America as well which will probably turn out to be heavy producers. As to South America, rather extensive explorations in most of the countries have failed to locate oil deposits of sufficient magnitude to bear materially upon the situation in the United States.

The Significance of Substitute Motor Fuels

The petroleum industry is so firmly established and produces such a range of products other than gasoline, that no engine fuel of non-petroleum origin need be counted on as capable of displacing gasoline.[9] Substitute fuels are to be regarded as supplementary resources, capable of affecting the situation broadly only as petroleum relinquishes the field through exhaustion.

There are three substitute engine fuels in sight—benzol, alcohol and shale-oil distillate. Benzol is now ready to compete with gasoline in a small way; alcohol and shale-oil distillate will be ready to compete only on a higher level of prices. As to resource capacity, benzol is a by-product of coal, and the quantity produced is dependent upon the coal subjected to by-product recovery; benzol will be manufactured in constantly increasing quantity, but the total supply can never fill more than a small part of the engine-fuel requirement. Alcohol and shale-oil distillate, on the contrary, are main products made from raw materials of almost unlimited availability; they may be produced to fill any need, however great, willing to pay the price. Whether shale-oil distillate or alcohol will eventually become the more important engine fuel cannot wholly be foreseen; but since shale-oil is similar to crude petroleum and can be made to yield an analogous range of products, a shale-oil industry is certain to supplement and eventually to succeed the petroleum industry, and hence shale-oil distillate is bound to become eventually a prominent motor fuel.[10] Alcohol on the other hand, is not so tied up with joint products, and its career as an engine fuel will be determined almost entirely by relative economy and its acceptability to engines evolving on the basis of oil fuel. If the engine type broadens so as to fit the petroleum resource, it will at the same time be prepared to receive the aid that benzol, shale-oil and alcohol may be called upon to render.

On the whole, then, there is nothing in the substitute engine fuel situation that would dictate to the automotive industry a policy differing from that determinable upon the basis of the petroleum issue. The substitute fuels remove any physical limit as to the quantity of engine fuel that may be produced; they offer greater assistance to the situation if present standards are less rigorously adhered to and automotive apparatus becomes adapted to a less volatile fuel than gasoline; they set the bounds to which the price of engine fuel of petroleum origin can advance—a very rough approximation of this figure being relatively 50 to 60 cents per gallon—suggesting, therefore, to the automotive industry an increase in thermal efficiency competent to offset the advance in price which the substitute fuels will permit and the petroleum situation will occasion.

Future Developments

The foregoing analysis of the resources and technology underlying the prospective supply of engine fuel indicates that the continued growth of the automotive demand will soon force either an extraordinary dependence upon cracking, with concomitant increases in production costs, or else a change in the character of the fuel so as to include more and more of the material now going on the market in the form of kerosene and fuel oil. The first adjustment is limited by the physical capacity of cracking, which is largely an unknown quantity, and the extent to which fuel costs can rise without involving curtailment in the growth of the automotive industry. The second solution is dependent upon the extent to which automotive apparatus may be adapted to consume a fuel less volatile than gasoline. Running through each solution, and serving to contribute to each, is the extent to which the thermal efficiency or fuel economy of the automotive apparatus may be increased. The more rigorously the present standards of low economy and specialized requirements are adhered to by the automotive industry, the greater the weight that will fall upon cracking, the greater and more sudden the inevitable rise in fuel price and the graver the danger of of an industrial reverse.

The fuel resources in sight indicate that a normal balance between supply and demand will eventually be reached, irrespective of the policy of the automotive industry, but the adjustment will result in a basis of price and character different from that now prevailing. The danger in the situation is not that of a permanent breakdown in fuel supply through exhaustion, but of a period of enforced readjustment to new conditions of fuel supply, which may come so suddenly as to catch the automotive industry unprepared and in consequence impose a serious handicap upon its prosperity, if it does not precipitate industrial disaster.

Situation Critical

The situation is serious, indeed critical, not only because the period of readjustment is apparently almost upon us (see Fig. 1), but because there are many aspects of the situation that tend to hide the real issues and to lend a false sense of security to those armed with an excess of optimism. American economic experience affords no parallel to the present engine-fuel situation; as demand in the past has almost invariably conditioned supply in American economic practice, it is an easy assumption that this will continue to hold in unabated vigor. New discoveries of oil pools are constantly coming into prominence. While the outlook for oil production never before appeared brighter, one easily overlooks the fact that each new pool, in proportion to its magnitude, adds to the unstability of the engine-fuel structure. At this very moment of writing, gasoline is piling up in storage and it is quite possible that before the winter is over the price will decline slightly. This may readily be accepted as controverting the whole argument of the paper, if the circumstance is not recognized as an inevitable reaction to a coincidence of season and post-war industrial readjustment. Upon all this come widely heralded announcements of new fuels, with extravagant claims and secret formulas, boldly promising at one stroke an easy solution of one of the most complicated industrial problems this country faces to-day. There are indeed specious arguments for sustaining conclusions quite the reverse of those arrived at here. While one series of circumstances is operating cumulatively to render the engine fuel situation more and more unstable, another set is serving to hide the real issue.

There is scant hope, at this late date, that the automotive demand will be brought into stable adjustment with the engine-fuel supply with results wholly conducive to the prosperity of the automotive field, but such difficulties as lie in store may be tempered if the industry as a whole recognizes its responsibility in this matter and acts accordingly. The exigencies of the fuel situation now urge, but shortly will demand, that the automotive industry work toward greater fuel economy and at the same time adapt its mechanical equipment to handle a less specialized fuel than gasoline. The first can be accomplished in some degree through car design, but in the main must depend upon engine changes in favor of greater thermal efficiency. The second can be accomplished either through the development of equipment not dependent upon fuel of high volatility, so as to permit the supply of "gasoline" to expand easily, or else by inducing the engine-fuel supply to bifurcate into gasoline at present grade reserved for passenger cars, and heavier distillates to be drawn upon by trucks, tractors, etc., fitted with semi-Diesel or other type of engine suited to such fuel. Apart from the disadvantage of greater costs involved in the production and distribution of two specialized fuels in the place of a single product, and the practical difficulty of unloading the problem

[9] Gasoline can be sold cheaper than any competitor, because of the possibility of shifting part of its cost of production to the joint products.

[10] It should be remembered, however, that many years must elapse before a shale-oil industry can become established and grow to significant proportions.

on the heavy-traction section of the automotive industry, the second expedient would in reality mean merely the turning over of the raw materials of cracking to a counter demand and would leave the gasoline problem still in acute need of attention. So the economics of the situation, the dictates of resources limitations and human needs, point to an automotive engine evolved into a type fitted to gain not only higher efficiency from the fuel consumed but greater economy in respect to the activities involved in the production and distribution of the fuel. The answer then is: Greater thermal efficiency in the engine and means for gasifying liquid fuel without requiring that it first be converted by a costly manufacturing process into a highly volatile product difficult to store and to transport.

Summary

1—The automotive industry is working without due regard to the engine-fuel situation.

2—This situation is an integral part of the automotive situation and should not be left out of account.

3—Owing to the pressure of automotive demand, the supply of engine fuel is in course of change, both in respect to character and price, with danger of precipitant alterations; there arises in consequence a fuel problem which cannot be adequately solved without the active participation of the automotive industry.

4—An analysis of the problem is as follows:

(a) The domestic production of crude petroleum is nearing its maximum.

(b) The natural gasoline content of this supply is lessening.

(c) Mexico offers no relief competent to solve the issue.

(d) Substitute fuels need not enter into present consideration.

(e) The supply of engine fuel can be maintained only through an extraordinary dependence upon cracking or through changes in engine type.

(f) Cracking cannot meet the issue at a favorable price.

(g) The burden, therefore, falls upon the automotive engine, which must consequently so adapt itself as to gain higher thermal efficiency, and to use less specialized (less volatile) fuel.

5—The automotive industry should therefore at once, as an emergency measure, take steps to shape its development in the direction of increased fuel economy and less specialized requirements as to fuel, establishing for this purpose centralized machinery to study the problem in full detail; should keep the industry informed of every development in the situation; should coordinate research and design in the competing units of the industry; and should conduct basic lines of research not now adequately encompassed by individual agencies.

The Unmined Supply of Petroleum in the United States*

Estimates of Quantity Still in the Ground Vary from 5,763,000,000 to 24,500,000,000 Bbl.

By David White

Chief Geologist, U. S. Geological Survey

THE justification of an estimate so highly speculative as must be that of the petroleum resources in the ground in the United States lies in the widening angle between the flattening curve of production and the rising curve of consumption. The standards of living, the industrial power, and the prosperity of the country are to so great a degree dependent upon our oil supply, and the question of the adequacy and duration of this supply so directly concerns, at the present moment, the individual citizen, as well as the public in general, that an estimate, even if it but a scientific guess, based, with careful study, experience and judgment, on the best information available, is imperatively necessary.

In response to the growing interest of the public four estimates of the oil resources of the United States have been made. In 1908 Dr. David T. Day,† then in charge of petroleum statistics in the U. S. Geological Survey, calculated the total amount of oil originally available in the ground as ranging somewhere between a minimum of 10,000,000,000 and a maximum of 24,500,000,000 bbl. In 1915 Dr. Ralph Arnold‡ placed the original supply of oil at 9,098,557,000 bbl., of which he believed 5,763,100,000 bbl. remained in the ground at the end of 1914. The third estimate was made by the geologists of the oil and gas section of the Geological Survey for the use of the Secretary of the Interior in responding to a Senate resolution of Jan. 5, 1916, and was published in Senate Document 310, Sixty-fourth Congress, first session, Feb. 2, 1916. According to this estimate the reserve of oil available at the end of 1915 was 7,629,000,000 bbl. In the spring of 1917 the producing or possibly productive area in the Western closely reconsidered with marked conservatism by the same geologists, each studying the regions with which he had field acquaintance, with the result that the total oil available in the ground at that time was estimated at 6,182,000,000 bbl.

In the preparation of estimates in the U. S. Geological Survey consideration has been given to the general character of the geologic formations—stratigraphy, geologic history, structure—the number, thickness, continuity and pore space of sands, the curves of production, the gas pressure, the water relations, and the results of drilling in near-by or geologically similar regions. A large part of the producing or possibily productive area in the Western States has been examined and mapped by the oil and gas geologists of the Survey or is now under examination. Typical areas in the Central, Gulf and Eastern States have also been studied. Nevertheless, the criteria upon which estimates can be based vary in every degree of inadequacy in the different regions, and the quality of the results, therefore, varies with the extent and character of the data available and with the personal equation of the estimators. Necessarily the estimates for areas not yet tested, especially those remote from the producing fields, are based upon theoretical conditions, carefully considered. For most of the areas estimates were first formulated by the geologists who had studied the areas. Later, these estimates were discussed in conferences.

(*Continued on page* 376)

*Paper presented at the annual meeting of the S. A. E.—Published by permission of the Director of the U. S. Geological Survey.

†U. S. Geological Survey Bulletin 394, pp. 30-50, 1909.

‡*Economic Geology*, vol. 10, No. 8, pp. 695-712, December, 1915.

Harley-Davidson Co. Brings Out Sport Model

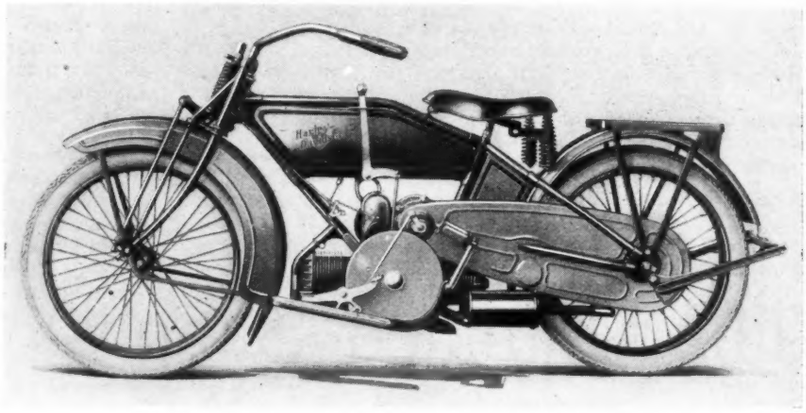
An Entirely New Design, Having a Two-Cylinder Opposed Engine, Multiple-Disc Clutch and Three-Speed Transmission Combined in a Unit Power Plant, Single-Chain, Inclosed Drive—A Solo Roadster of 257 Lb. Weight

AFTER having for more than a decade built motorcycles with single and two-cylinder V engines, the Harley-Davidson Co. of Milwaukee has brought out a new model fitted with a two-cylinder opposed engine. This is an entirely new design, and the cylinder displacement is considerably smaller than that of the previous Harley-Davidson twin machines, being only 35.6 cu. in. as compared with 61. The machine is known as a sport model, and is classed as a moderate weight type.

Quite a departure from conventional practice is the use of a unit power plant, which does away with the short chain drive from the engine to the transmission, formerly used by most makers of motorcycles, affording a number of forward speeds.

The elimination of this chain, together with the inclosure of the final drive, insures complete protection from mud and dust of all parts of the driving mechanism, and should add greatly to the life of the machine. A first reduction in speed from the engine to the transmission is obtained by means of helical spur gears, which are inclosed and run in a bath of oil. This type of gear is used on account of its noiselessness. Lubrication of the final drive chain is secured by leading the breather pipe into the chain case, so that the oil-laden air from the crankcase is directed onto the chain.

The new Harley-Davidson sport model is designed as a solo roadster for cross country work. It weighs 257 lb., and the manufacturers lay emphasis on the point that it is not a light weight machine in the sense that this term has been usually applied. A speed of 50 miles per hour can be maintained on good roads, and the engine is said to be so flexible that it will admit of throttling down to a pace which obliges the rider to use his feet to steady the machine. For power and hill climbing ability the machine is said to be the equal of any standard twin cylinder.



Harley-Davidson sport model, left side

From an operating standpoint one of the important features of the sport model is its low center of gravity, which is due partly to the use of 26 in. wheels and partly to the type of engine fitted. The saddle position is low and well forward, and the machine is claimed to handle well in mud and sand.

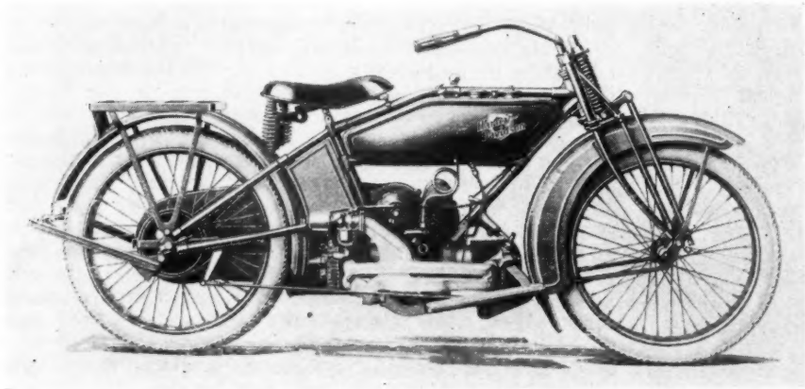
The engine is of the well known two-cylinder opposed type, with cranks set at 180 deg. It has a bore of 2¾ in. and a stroke of 3 in., giving a piston displacement of 35.64 cu. in. While the rating is 6 hp., it is stated that it will develop considerably more than this.

Crankshaft Carries Balance Weights

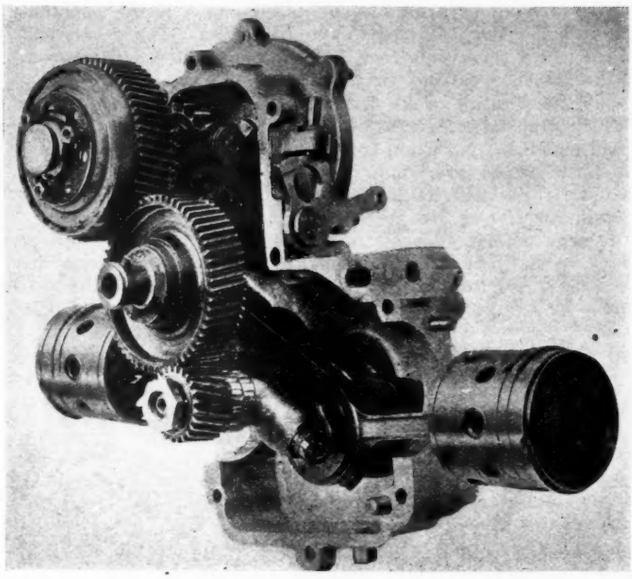
Following previous Harley-Davidson practice, roller bearings are used in the engine, both main and crank pin bearings being of this type. These bearings are made by the Harley-Davidson Co. itself. Notwithstanding the fact that a two-cylinder crankshaft with opposite throws has a very good inherent balance, balance weights are attached to the two short crank arms, so that the engine should operate with very little vibration. The method of attaching these balance weights to the crank arms is of interest, and is shown in one of the illustrations.

An outside flywheel is used, and is built up of pressed steel discs, which are inclosed in a neat guard, so that the wheel will not throw any water, sand or mud onto the rider's clothing.

The valves are located at the side of the cylinders, one above the other, but not in the same vertical plane, the object in thus staggering them being to permit of operating both sets of valves from a single, horizontal camshaft. All valve ports have a clear diameter of 1¼ in. The plugs over the valves are provided with cooling fins. Only two cams are required for operating all four valves, one intake cam and one ex-



Harley-Davidson sport model, right side



Assembly of power plant parts, showing especially the pistons, clutch and helical gearing

haust cam. The valves are actuated through the intermediary of a simple tappet lever without rollers. Cams and tappet levers operate in a bath of oil. Valve stem guides are screwed in place. All valves may be ground into their seats without removing the cylinders from the engine or the engine from the frames. It is also possible to decarbonize the engines without any great trouble, as the cylinders can be removed without taking the entire engine out of the frame.

In the design of the new engine account has been taken of the constantly deteriorating quality of motor fuel. A combination cast inlet and exhaust manifold is used, which extends between the valve ports of both cylinders and is fastened to them by means of a stud and nut at each end, a gasket insuring a gas pipe joint. That part of the intake pipe in which condensation is most likely to occur is heated by a by-pass from the exhaust pipe, to such a degree that "loading" is said to be entirely prevented. The use of this form of combination manifold does away with a good many joints and greatly simplifies the construction. A standard ¾-in. Schebler carbureter is fitted, and is provided with a cylindrical dust baffle. The latter is an air-filtering device which prevents road dust and sand from reaching the inside of the engine through the carbureter air valve.

Ignition is by a high tension magneto mounted on top of the crank case. Metric spark plugs are used, and are so located that they can be easily gotten at, yet so that their operation is not likely to be interfered with by splashing mud and water. Priming cocks are screwed into the cylinder walls close to the spark plugs, so that the gas formed by the priming charge will be in the vicinity of the plug and be sure to be fired.

Lubrication of the entire power plant is effected automatically by means of a plunger pump with rotary valve. This pump may be adjusted to feed more or less oil by lengthening or shortening the stroke of its plunger. A bull's-eye makes it possible to watch the oil feed. For emergency use a hand pump is provided.

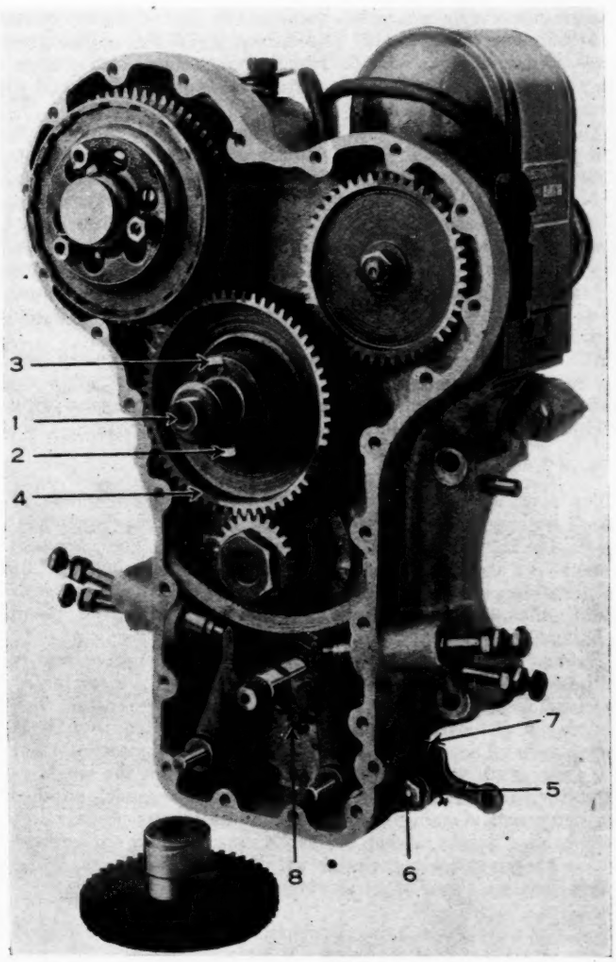
Lubrication System

The oil pump delivers the oil into the case inclosing the helical driving gears, where it serves to lubricate these gears, the bearings and the disc clutch. From this casing the oil overflows into the crank case of the engine, where it lubricates the main and crank pin bearings, the wrist pin bearings and the cylinder walls. As the transmission is located on top of the crank case, and is formed with an open base, so that there is direct communication between the crank case and the gear case, lubrication of the transmission gears is effected by the spray from the revolving crankshaft. The drive chain, transmitting the power from the transmission to the driving wheel, also receives its lubricant from this single source. It is carried to it in the form of a mist through the crank case breather valve, which discharges into the chain case. Ports are drilled in the secondary gear hub, and in the stud upon which it revolves, so that the secondary gear is made to serve as a crank case breather valve. This farther simplifies the construction. The breather pipe leads from the top of the driving gear case direct to the driving chain case.

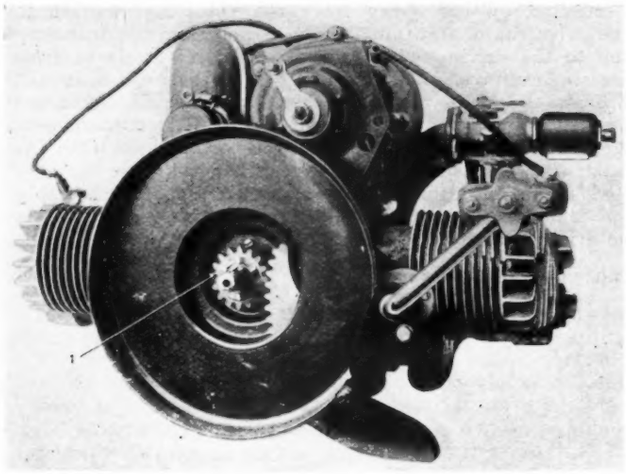
Multiple Disc-in-Oil Clutch

An innovation for the Harley-Davidson Co. is the use of a multiple disc-in-oil clutch. Owing to the fact that the clutch is located in the driving gear housing, in which there is a constant supply of oil, the use of this type of clutch does not call for any additional attention. In the earlier experimental models, a plain steel disc type of clutch was used, but this has now been replaced by a design in which one set of discs is provided with what is referred to as composition inserts. There are 13 discs in the clutch, made of saw steel carefully tempered. If adjustment of the clutch is ever called for this can be readily attended to. The clutch is controlled by a pedal convenient to the left foot of the driver.

The arrangement of the transmission is substantially the same as that of the three-speed sliding transmission used on the Standard Harley-Davidson twin motorcycle, which has already been described in AUTOMOTIVE INDUSTRIES. On the high gear a reduction of 5:1 is obtained; on the intermediate gear, 8.33:1, and on the low gear, 13.87:1. One of the



Unit power plant with gear cover removed. Valve operating mechanism at the bottom of the figure



Unit power plant with flywheel removed, showing starter gearing

greatest improvements over previous models is the elimination of the intermediate chain drive. The one remaining chain is completely inclosed, and is therefore protected against excessive wear due to dust, sand and mud getting into its links, as well as against rust. The chain being at all times kept clear and well supplied with oil, wear is very slight and adjustment is required only at long intervals. This adjustment, moreover, can be made without disturbing the chain guard. The hubs and brakes are of Harley-Davidson manufacture. Large hubs with substantial flanges, cones and ball races are used. The brake is of the contracting band type, and is claimed to hold the machine in either direction. Its drum is 7 in. in diameter and has a brake band of 1 in. width acting upon it.

The frame is of the double bar thrust type, and when the unit power plant is in place it forms a keystone construction. Seamless, high carbon steel tubing 1⅛ in. in diameter and of Nos. 12 and 16 gage is used for the frame. The steering head bearings are of the same design as those on the larger Harley-Davidson model, although slightly smaller in size. To facilitate the installation of the power plant in the frame by one man, a small shelf is provided on which the power plant can be rested just before the clamping bolts are slipped into place.

Although the center of gravity of the machine is very low, the road clearance is 5½ in. The manufacturers point out that this is equivalent to a greater road clearance with a machine of long wheel base.

Fork of Caster Type

The fork is of the trailer or caster type; it is made of round, seamless steel tubing, and features the Harley-Davidson double stem extension fork side principle. Side play and wheel shake are prevented by the balancing rocker arms. The main cushion spring is a large, resilient coil, which is placed outside the steel tube or cylinder which carries the recoil or balancing spring.

The starter is made up as a unit with the engine, and is on the left side of the machine. It turns over the engine at sufficient speed to start it readily, and may be operated with the gear shift lever in any position provided the clutch is disengaged. The starter is protected by a substantial steel shoe from mud, sand and water thrown up from the road.

One-inch tubular steel double-stem handlebars, with handlebar stems and steering bars proper made in one piece, eliminate brazed joints at top of the stems. The grip control mechanism is entirely inclosed within the handlebars. The system used is the Harley-Davidson double-acting wire control.

The tires are 26 x 3 in., which is very liberal equipment for the weight of this machine. Rims are standard CC type steel rims. A regular motorcycle saddle is fitted, and is mounted on the Harley-Davidson Ful-Floteing seatpost. The luggage carrier affords an 8 x 14 in. carrying space.

Five-inch mudguards are furnished and a large, substantial splasher flap is fitted to the front one. The rear mudguard has a removable rear section to permit ready removal of the wheel in case of tire trouble.

Gasoline and oil tanks follow very closely the lines of the tanks on the larger Harley-Davidson model, and have no exposed seam and no sharp corners. On the new model, however, the tanks are made up as one complete unit. The gasoline tank holds 3 gal. The oil tank holds 2 quarts, or enough for 400 or 500 miles under ordinary conditions.

A large muffler silences the exhaust so it is hardly noticeable. A tail pipe directs the exhaust gases away from the machine. A cutout is provided which may be readily operated by the foot without the rider taking his eyes off the road.

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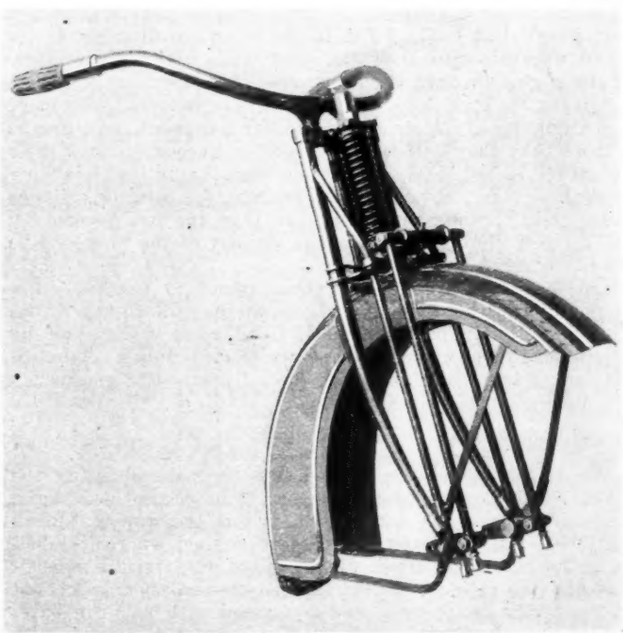
Acetylene as Motor Fuel

NOT much has been heard in late years regarding the use of acetylene as fuel in internal combustion engines, after experiments during the early part of the century had yielded no commercial results. Quite recently, however, references to the use of this fuel are again being met with in the European technical press, which may be a result of the gasoline famine in some countries consequent upon war conditions. Thus the *Tecknisk Ukeblad* reports that a motor transport service, running exclusively on carbide, has been maintained throughout the summer on a route 116 km. long between Kristiansand and Aaseral. Also a trial trip has just taken place with a 52 hp. motorboat, "Falken," driven by a six-cylinder Thornycroft petroleum motor, adapted to carbide by being fitted with a special vaporizer and air-mixing valve. The carbide containers, three in number, are situated on deck with pipes leading to the engine below. The Swiss Acetylene Society recently published the results of precise measurements on the gas consumption of acetylene engines. The measurements were made on a 30 hp. truck engine, and the output determined by an electric dynamometer. The engine under test made the same speed of revolution at all loads. The results were as follows:

Brake hp.	Total consumption cu. ft. atmosphere	Specific gas consumption: cu. ft. per hp. atmosphere
10.5	136	13.1
17.0	177	10.3
22.8	238	9.9
27.2	252	9.2



Front fork, handle bar and wheel guard

The FORUM

In Defense of the Bristol Fighter

By S. W. Symons, Lt. R. A. F.

AS a constant reader of Automotive Industries and a pilot who has spent considerable time on Bristol Fighters, I cannot permit the many statements which have been printed in the American press, belittling the performance of the Bristol Fighter, to go unchallenged.

I do not blame the American press for these statements; I know full well that they emanate from official sources and that is the obvious reason for their inaccuracy.

The reported obsolescence of the Bristol Fighter might in itself pass unnoticed. You are well aware that the Bristol has been in use at the Front for the better part of two years, a long period for any machine to remain up-to-date under war conditions, and a new "Super" Bristol has been under way for several months past, though it may now never see the light of day. However, it is the statements which belittle the performance of the Bristol which I wish to criticise, and particularly those comparisons, on a purely fighting basis, between the Bristol and D.H.4. (itself obsolete) which are misleading and in many cases inaccurate.

In comparing the Bristol Fighter with the D.H.4. (or D.H.9. which has superseded it) it should be borne in mind that the D.H.4. is an armed bomber and is not intended to fight unless forced to, while the Bristol is purely a fighter and only used for bombing incidentally, though, due to its ability to take care of itself in a scrap, it has been used very successfully on "lone" photography and reconnaissance "shows" and even for trench "straffing," where usually only the lightest machines are used.

The D.H.4. and Bristol machines frequently work together. It is no uncommon thing to see a squadron of D.H.4. machines start on a bombing "show" escorted by Bristol Fighters, and if there is any fighting to be done, it is left most religiously to the Bristols.

With an expert fighting pilot and observer the D.H.4. can give an excellent account of itself in a scrap, but again, not being a fighting machine, neither pilot nor observer is picked for his fighting qualities, and even the most expert would be at a disadvantage owing to the D.H.4. having such poor stunting qualities, so essential for fighting. The Bristol, on the other hand, is designed primarily for fighting and both pilot and observer are given a special training in gunnery and fighting practice, and, of vital importance, the pilot must qualify as a "stunt artist" before going overseas. In stunting capacity the Bristol is only excelled by some of the small and fast scouts.

In regard to actual work in France, I can only say that the Bristol Fighter was feared by the Huns as much, if not more, than any other British machine and they had no two-seater to touch it in performance. I have known personally of many occasions when a single Bristol has been set upon by six or more Hun scouts and got away with it, with at least one Hun sent "west." It is a peculiarity of the Bristol, due largely to the rear gun, that the Huns will not attack a single machine unless they outnumber it at least four to one. In more recent scraps, where large formations have been employed, I have known of several cases where formations of six to twelve Bristols have run into the famous circus, numbering anything from 25 to 50 Albatross and Fokker scouts, and again come out best. My own squadron one morning brought down thirteen Huns in a 2-hr. "dog fight" without the loss of a single machine. A pal of mine, in another Bristol squadron, started out with a formation of twelve and came back with a bag of 15 Huns and no losses. A flying officer in my squadron went to France in January, 1918, had his first scrap late in February and between that time and September, had—officially—destroyed 34 Hun planes, had been decorated three times, and risen to the rank of Major; these are but a few Bristol records; they could be multiplied by the hundreds.

To turn in detail to some of the statements and criticisms in the American press, statements which the press cannot be held responsible for since, as before noted, they presumably come from official sources.

In your issue for Sept. 26, 1918, page 548, the types of engines used in the Bristol are listed, and a statement of performance is given.

The engines listed are the 190 Rolls, 150 and 200 Hispano, and the 200 B.H.P. As a matter of fact the only engine used to any great extent is the Rolls, the use of the other types being practically negligible, and the 190 Rolls was superseded in December, 1917, by the 264 Rolls (sometimes known as the 275). This engine is really a highly improved 190, but the 40 per cent increase in power had a marvellous effect on the performance of the plane. Apparently this information had not been given out in the States in time for publication in the issue of Sept. 26 of Automotive Industries. In other respects the report is sufficiently accurate, except that the front gun carries 500 rounds instead of 88.

As regards the failures experienced in the early part of 1918, noted in your issue of Sept. 5, page 404, which apparently damned the machine in the eyes of Americans, these were undoubtedly serious, though luckily very few. They were due entirely to slight changes in wing construction, made by the manufacturers and changed as soon as the results came to light. All existing machines were also modified so that a repetition was made impossible. When it is considered that Bristols have been dived at over 300 m.p.h. (I myself have been in a dive at over 230 m.p.h.) any rough handling in pulling out, or a slight reduction in wing strength, is bound to result in failure, yet Bristols are constructed so that pilots handle them as though it were not possible to break them and you can do things with a Bristol which would make a D.H.4. collapse.

The real reason the Bristol was washed out in the U. S. A. is that the Liberty engine did not suit it. It was too heavy and too powerful and it is a pity that this reason was not frankly stated, though it was obviously due to the mysterious workings of the official mind.

In conclusion I cannot but admire the frankness with which the American press has reviewed the airplane situation and admitted the many deplorable mistakes, mistakes which have now happily been completely cleared up and cannot now affect the winning of the war.

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Recovery of Manganese from Slag

A GERMAN patent, No. 307,393, of March 7, 1916, describes means for recovering manganese from low-percentage manganese-carrying blast-furnace slag. In an electrical furnace a sump-bath of iron, or clippings and turnings, is melted without access of air, and into this the blast-furnace slag of basic proportion of 1 to 0.8 is put, and the bath raised to the highest temperature possible. When fusion has taken place, as much lime is added as the fluidity of the bath will permit. A better reduction of the manganese is thereby effected, due to the increased basic qualities of the slag. The sulphur and manganese compound of the blast-furnace slag is broken up, and the sulphur carried over to the final slag. To the whole molten bath a reducing agent is then added in the form of small pieces of coke, whereupon the reduction of the manganese and oxygen compounds takes place according to the equation $MnO + C = Mn + CO$. The reduction is greatly facilitated by the use of lime and coke, prepared in the electrical furnace, where, under the action of the electric arc, calcium carbide is formed, which substance serves as the carrier of the carbon required. The molten iron takes up the reduced manganese, forming a ferro-alloy. Manganese is used as an alloy in steel and hardens the latter.

Social Surroundings Have Important Bearing on All Labor Questions

Comfort and Home Life of the Worker Will Modify Extent and Acuteness of Unrest and Migration

By Harry Tipper

FOLLOWING our last week's article, giving some particulars as to the condition of labor in the automotive field in this country, it is necessary to consider the general figures of the case not only, but also the prospects of difficulty with organized labor in this field during the period.

It is to be observed that since the armistice was declared there have been a number of strikes among skilled workers in several industries and in many localities, asking either for higher wages or for shorter hours, and apparently aimed at the prospective reductions in labor prices which are likely to occur and adopted as a means of strengthening the position of the organized labor bodies under the circumstances. These strikes have not become acute, and in most cases they have been settled very promptly. They indicate rather the beginning of the post-war period of unrest, which will be accentuated in proportion to the difficulties met in redistributing the labor to take care of the present industrial requirement.

It is obvious that in Europe the organized labor bodies are determined upon carrying out the very radical socialistic program which they have adopted during the war period and which has been expressed in the platforms emanating from their conferences. It is significant to note that the trouble from general strikes in Great Britain is more widespread and covers a larger number of industries than at almost any other previous time. It is also evident that the strikers present a much more determined front and a much more complete and effective organization than they have been able to show at any other period.

Political Demands of Organized Labor

It is not likely that we shall be troubled in this country with the severe conflict between labor and capital which is occurring in Great Britain, but the example of the European countries and the presence of a considerable body of radical opinion among the labor organizations would suggest that some severe labor unrest will occur based upon the desires of the organized bodies of labor for a larger control politically and industrially at the present time when public opinion is sufficiently fluid.

The platforms of the organized labor conferences in various states continue to exhibit demands which are mainly political and which are radically socialistic in their point of view. It is to be noted that the demands made on these platforms have extended themselves politically very much further than any labor organization permitted before the war began. In several of these adopted resolutions of various state conferences of the labor federations the demand for the government ownership of public utilities has been extended, so that the demand now takes in the ownership and distribution of coal, food products and of other important matters. The only difference, therefore, between the situation in Great Britain and the situation in this country lies in the relative weakness of the labor organization, which prevents their passing to the extreme measures that are being adopted on the other side.

The power and influence of organized labor have been greatly extended during the war, until this body, variously estimated as comprising from 14 to 20 per cent of the total supply of labor in the country, has exercised an influence so far beyond the boundaries of its own organization, in the last few months, that in many industries its effect is as great as though it comprised 80 or 90 per cent of the total labor instead of a minority. It is this increase in political influence which makes it impossible to predict with safety the demands of labor and its willingness to accept the process of readjustment without a more or less severe conflict. The necessity for redistribution of skilled labor from one part of the country to another and from one type of work to another, with the necessary period of unemployment, is in itself a cause for social unrest and discontent. People do not move readily from their homes unless the necessity is severe, neither do they accept a change in their economic condition which involves the acceptance of less pay until necessity compels them to do so.

Question of Wages Is Minor

In the meantime the enforced idleness and the comparative sacrifice taken together with the ceaseless activities of the radicals are calculated to lead to unrest and to lay the foundation for further difficulties between the organized bodies of labor and the industrial owner. It is probable that idleness and the social causes of discontent are at all times more important in their bearing upon labor troubles than the question of wages *per se*. The question of housing, the character of the surroundings and the bearing of this on comfortable home life are always important, and at no time of greater importance than at the present.

At South Bend, Ind., this week the Studebaker Corporation presented to the citizens of South Bend their plans for the addition of new factories which would require 12,000 workers besides those already employed. At the lowest estimation this means an addition of 40,000 people to the population of a city whose present population is around 75,000. It was interesting to note that the great concern of the Studebaker Corporation in presenting this matter was the question of the provision of proper houses, schools, churches and the accompanying public improvements in order that the workmen could be secured and induced to remain.

The relations between the Studebaker Corporation and its employees are evidently very friendly, and the plans which the company have in mind indicate that they expect

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to make developments in profit sharing, etc., which will increase this amiable contact. The corporation recognizes nevertheless that nothing which it can do in the way of organization developments, in giving the worker a share in the responsibility for the enterprise, can be effective unless the social surroundings are at least reasonably comfortable.

Large bodies of skilled and unskilled laborers were moved during the war period into specific locations in order that the urgent requirements of the war could be met. The Government did a great deal of work in housing these workers and the immediate problem was solved.

In the redistribution of labor from the concentrated necessities of the war to the development of peaceful occupation these social surroundings will have a great bearing upon the labor unrest, both as to its extent and acuteness. Thousands of workers will not move back to their old places, and cities which have not been faced with a large amount of unemployment because of the cancellation of war contracts will be faced with an unemployment problem due to the migration of workers, either from war industries or from the demobilization, who have decided not to go back either to their old life or to their old occupation.

The general unemployment figures show an increased number of skilled and unskilled workers who are idle, and this idleness will automatically breed labor trouble, discontent and unrest, and may lead to some disorder. In this respect the automotive field is interested not only in its own labor problem but in the general labor conditions throughout the whole country, because the stability of labor in this particular industry and the relations between employer and labor will be directly affected by the surrounding conditions in other industries in the immediate localities or general territory.

All things considered, this is the proper time for every manufacturer who desires to stabilize his labor and to meet the return to peaceful production with a minimum of trouble to begin the development of those organization plans which may be necessary to establish the proper basis of confidence between the employer and his employee. This point cannot be emphasized too strongly. The platforms of the state labor conferences show that the political influence and the desire for control are extending the demands of the labor organization and leading directly toward experimental and socialistic legislation and further conflict industrially. The unfortunate difficulties in the way of a rapid readjustment will add to the force of these demands the idleness and the social unrest which always accompany any large necessities of that kind.

Changes May Invite Disaster

It is becoming clearer all the time, from the progress of conditions in the older countries, that the growth of labor organizations to the point of control will so seriously change the political and industrial aspect as to invite disaster. It is a question whether in the older countries the matter can be solved without an experimental period of socialistic government. The tendency in this direction has gone so far and the movement has acquired such momentum that such a conclusion is inevitable.

In this country the strength of organized labor is not sufficient, neither is the movement in this direction of such proportions that experimental legislation need be considered inevitable. It is still possible to solve the problem without seriously changing our fundamental practices in the governmental, industrial and social relations, but this depends entirely upon the action of the manufacturer and how far he is willing to go in taking the worker into discussions which establish the conditions of his work, the extent to which he is prepared to share the profits of the business with the worker and the distance he expects to travel in the analysis of the fundamental requirements of this proposition.

The present situation is not satisfactory either to the worker or to the manufacturer. The worker will disregard the mandate of his own executive council when there is any local advantage to be gained thereby just as readily as he will disregard the necessities of the manufacturer. The present labor organization is incapable of offering more than a temporary settlement. No organization of manufacturers can do more. The manufacturer must decide whether he will bargain collectively, inside his own organization with his own workers, or whether he will bargain collectively with the outside organized labor body. He must decide whether he will fight for control against the constantly increasing political power of organized labor and the constant tendency toward more radical demands, or whether he will gather together with his own workers in a group unified in purpose so that it can fight for its own place in the industrial world.

The practical considerations of the effect of these things upon the amount of production per man and upon the other economic items is beside the question at the moment because the whole fabric of industry is threatened with severe political readjustments unless the matter is solved or at least the basis of solution is made.

Political Power Not Understood

Even now the manufacturer does not realize the industrial significance of the present attempt in some quarters, backed by many of the labor organizations, to put the railroads under Government ownership. Even now the increase in political power of organized labor is not properly understood. It is a question whether any manufacturer realizes the extent to which the professional classes and the salaried classes of employees are in sympathy with some experiments in Government ownership and other socialistic tendencies. There is no sympathy among the large body of citizens of this country for the industrial aristocracy controlled exclusively by a few private individuals and passing no share of the responsibility to the worker. There is a great desire among the large body of citizens for an orderly solution of these industrial problems of labor which will avoid the acute difficulties in which the older countries find themselves, which will prevent us from rushing into experimental legislation of a bureaucratic nature and which will at the same time give the worker some share in the responsibility for the conditions of his own work and some share in the common object of the industrial organization of which he is a part.

Socially, politically and industrially we are in a period of change, and the industrial so intimately affects the social and political that all these changes will react one upon the other, and the action of the manufacturer in dealing with the labor problem in the next few years may govern the tendency of our political development and the conditions of our social existence.

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THE first batch of airplanes ceded by the British Government to Chile has reached Valparaiso. It will form the nucleus of the new Chilean Air Service, which, as a start, will consist of 14 seaplanes and 50 airplanes, all machines originally built for the British air services. Major Huston, of the British Flying Corps, is to act as chief instructor of the new force and Engineer-Lieutenant Solano is to be the technical head of the naval section of the service. The first Chilean naval base will be the island of Omiriguina, almost in the middle of Talcahuano Bay.

SIDE GUIDE AND GRIPPER

Over 1200 at S. A. E. Victory Dinner

NEW YORK, Feb. 7—That the automotive future holds even greater opportunities and presents engineering problems of more import than the past was the theme of the Victory dinner held by the Society of Automotive Engineers last night and attended by more than 1200 members and guests of the society. Speakers included C. F. Kettering, president of the S. A. E.; Charles M. Manly, president-elect of the S. A. E.; Alfred N. Reeves, general manager of the N. A. C. C.; John N. Willys and George F. Houston of the Wright-Martin Aircraft Corp. Job E. Hedges was toastmaster.

Discussing aeronautics, George F. Houston briefly presented a problem that is probably of as great importance to the automotive industry as any at this time, the present and future of aviation. The past, he declared, referring to the war, was a testimonial to the engineering and productive skill of the American automotive industry, the present—"the less said the better"—but the future, he is certain, will find the airplane and the airship firmly established and accepted in an important niche in the commercial world.

War Has Developed Co-operation

The engineer, said C. F. Kettering, urging wide co-operation, who closes the door of his research department "shuts out more valuable information than he keeps in." The war, he said, has developed co-operation between automotive engineers to the highest degree, and that co-operation must be continued to insure solution of the huge problems before us.

Capital must recognize its obligations to labor, and labor in turn must recognize its debt to capital, said John N. Willys, who told of his plan to divide the profits of his various companies with the workers "above a just and reasonable wage compensation." The Ford plan, he said, not only provided the workers with greater remuneration, but increased their incentive and consequently their productive output, and he stated frankly that if the clock could be turned back he would follow the Ford plan in less than 24 hours after its inauguration.

Alfred Reeves, discussing the past year and the general governmental attitude toward the industry, and the future of the automobile, said that the industry is now recognized as vital and important, and chiefly utilitarian.

Others at the speakers' table included: H. R. Sutphen, president of the National Association of Engine & Boat Manufacturers; F. H. Russell, president of the Aircraft Manufacturers' Association; Camillo Cerruti, chief, Italian Military Mission in the United States; C. W. Stiger; Capt. E. C. Hugh, British War Mission; Capt. George Sykes, British War Mission; C. E. Thompson, president of the Motor and Accessory Manufacturers' Association, and Col. A. O. Seaman, Motor Transport Corps.

Annual Dinner of the Society of Automotive Engineers, Feb. 6, 1919

S. A. E. Annual Meeting Concludes

Three-Day Meeting Well Attended—Papers Centered Around War Accomplishments and the Fuel Situation—Dinner Attendance a Record One

NEW YORK, Feb. 8—One of the most valuable meetings ever held by the Society of Automotive Engineers came to a close yesterday. The three-day session embodied a program covering the vital developments in all phases of automotive activity. The high spots were undoubtedly the discussion of the influence of aeronautic practice on future motor car design and the symposium on the fuel situation, which occupied the attention of the members during an entire forenoon.

Higher standards of manufacture are sure to result from the lessons gained in airplane work. It was predicted by the three engineers—H. M. Crane, O. E. Hunt and Howard Marmon—that in the future we will see much greater co-operation among engineers as a result of the general discussion in laying out the Liberty engine and other airplane developments during the war. While it is true that the automobile and automotive industry has always been distinguished for the great amount of co-operation existing between even competing concerns, the war has carried that co-operation to a far greater extent, and it seems certain that the engineers who got together on airplane development, as well as on other phases of war work, will continue to co-operate in the future.

Seriousness of Fuel Situation Emphasized

The seriousness of the fuel situation was brought forcibly to the attention of the membership during the meeting, and it seems certain that out of the discussion will come a Fuel Division of the Society which will take care of this development and co-ordinate the efforts of the engineering profession and the refining industry. This matter is discussed more fully elsewhere in this issue.

It is regrettable that there was not time at the meeting for discussions. There were a great number of papers which were well chosen and dealt with vital questions, but they could not be discussed because of lack of time. Surely a great many thoughts must have been suggested by the reading of these papers, but they could not be given expression. It would seem that in the future it would be better to have either shorter or fewer papers in order to permit the membership at large to make comments or ask questions.

Sessions Well Attended

The attendance was excellent, keeping the auditorium of the Engineering Societies Building practically filled at all times. It was distinctly noticeable that the crowd was a shifting one, specialists from each of the different fields attending the meeting which most interested them. The broad nature of the work of the Society was brought out more strongly in this way than ever.

One of the features of the arrangement of the program was the grouping of the subjects so that it permitted of the attendance of those interested in any topic at the particular meeting which most concerned them. In this way the topics were covered thoroughly at a single session, and had there been opportunity for discussion it is quite certain that it would have been highly important because the leaders of the respective fields were in attendance at each of the sessions.

The final feature of the S. A. E. program was the banquet held at the Hotel Astor. This was attended by 1300 members and guests, and was one of the greatest affairs of the kind that the Society has ever held. The demand for seats was so great that although the largest banquet hall in the city was utilized, there were many who could not secure accommodations. President C. F. Kettering closed his highly successful year by introducing the toastmaster, Job E. Hedges, who presided on this occasion. Among the other speakers were Al Reeves of the N. A. C. C.; the new president-elect, C. M. Manly, and John N. Willys.

Kettering's Novel Theory

One of the most interesting phases of the professional session was the presentation of an entirely novel theory on what really happens within the cylinder of an internal combustion engine. C. F. Kettering spoke of the formation of secondary products within the cylinder, these being very often of a detonating nature causing knocks which have hitherto been classified as pre-ignition knocks. While Mr. Kettering did not present any scientific proof regarding his theory, he stated that he had reason to believe that some of the secondary compounds formed were acetylene gases. Mr. Kettering illustrated his address in his inimitable way by comparing the molecules in a given quantity of fuel with the potatoes in a bushel basket. He said that if the potatoes were all put in an oven for a sufficient length of time to cook, those of average size, the little ones, would be burned, while the large ones would be raw. This, he said, is what happens to a fuel with a number of constituents of different boiling points. The result is that some of them are submitted within the cylinder to temperatures which cause cracking, thus giving rise to the hydrocarbon secondary compounds which may be of a detonating nature, causing sudden high pressures to be reached, giving momentary but acute bearing stresses.

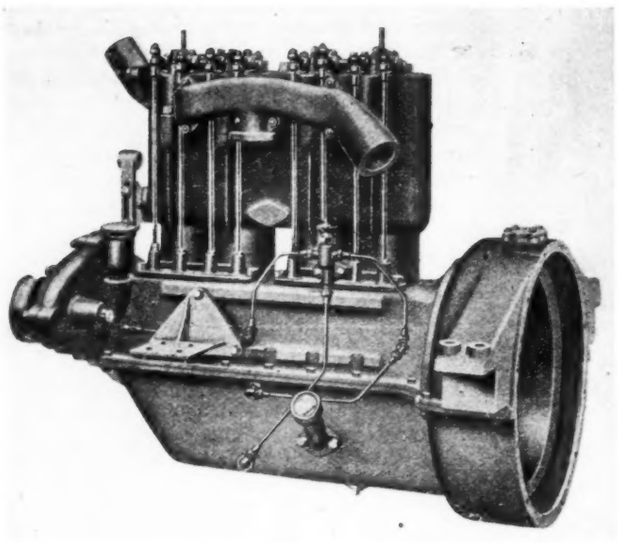
Membership Manifests Keen Interest

Throughout the entire session, the influence of Past-President Kettering's brilliant wit and effective graphic method of presentation made itself felt in creating a keen interest in what are more or less abstruse subjects, even to those who follow engineering practice. An instance of this was where Mr. Kettering showed the lack of value of chemical formulas as pertaining to the hydrocarbon series, where the same hydrogen contents and, in fact, the same contents of other elements, produced entirely dissimilar compounds because of the different arrangement of the atoms.

The program was well balanced, including a discussion of airplanes, tractors, motor trucks, motor boats, as well as automobiles and the fundamental problems which are equally applicable to all. On the tractor paper there was some discussion regarding economy, showing a surprising difference between the results obtained by British users and those in the United States. It was shown that on the other side where official tests had been conducted the fuel economy was much less than that experienced in the United States.

Gray Victory Four-Cylinder Engine

To Be Made in a Passenger Car Type with Aluminum Base and Bell Housing and in a Truck and Tractor Type in An All Cast Iron Construction



Gray Victory engine, left side

A FOUR-CYLINDER block cast engine of 3½ in. bore by 5 in. stroke has been put in production by the Gray Motor Co., Detroit, Mich. It is of the valve-in-head type, and is intended both for passenger cars and for trucks and tractors. Special emphasis is laid by the manufacturers on the provisions made in the engine for vaporizing the fuel, and high efficiency and great economy are claimed with the present grade of gasoline.

All four cylinders are cast in a block, together with the upper half of the crankcase. As the cylinder heads are separate from the cylinder block, it is possible to completely machine the compression spaces, and thus insure uniform compression in all cylinders. The cylinder bores are ground to size, and the cylinders are offset from the crankshaft axis to reduce the mean side thrust of the pistons against the cylinder walls. Inlet and exhaust passages are cored in the cylinder head, and there are two hot spots which are claimed to insure thorough vaporization of the fuel, and consequent complete combustion. A McKim gasket is placed between the cylinder block and head, and the head is held in place by means of heat-treated cap screws fitted with lock washers. The bottom half of the crankcase is made of cast iron for truck and tractor engines, and of aluminum for passenger car engines.

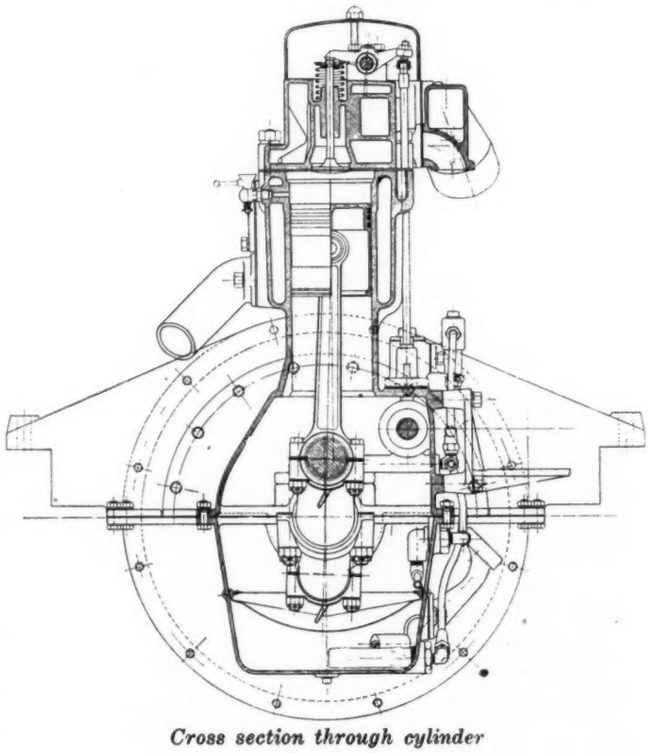
Both sets of valves are interchangeable, and in order to permit of making them of large sizes, the cylinders are counter-bored from the top end. The effective diameter of each valve is 1 21/32 in. The valves have carbon steel stems and cast iron heads, the latter of 2¼ in. outside diameter. The pistons are of conventional design, of cast iron, and are provided with three diagonally split expansion rings each. The connecting-rods are I-section drop forgings and measure 9¼ in. between centers. The crank pin bearings are 1¾ in. in diameter, by 2 in. long, and are made of die cast babbitt. Bearing caps are held in position by nickel steel bolts with castle nuts and cotter pins.

The crankshaft is made of 0.40-0.50 per cent carbon steel, heat treated and ground. It is supported in three die cast babbitt bushings, all 2 in. in diameter, and of the following lengths: (front to rear) 2¾ in., 2 in. 3⅜ in. The bearing caps are made of malleable iron, and are held to the cylinder block by means of heat treated studs fitted with castle nuts and cotter pins. Laminated shims are placed between the caps and the upper half of the bearing.

Bearing Dimensions

A three bearing cam shaft is used, made from low carbon steel, carbonized and ground. This shaft is 1 1/16 in. in diameter, and has its bearings directly on the cast iron of the cylinder block. The dimensions of the bearings are as follows: (front to rear): 1 13/16 x 2½ in., 1¾ x 2 in., and 1 11/16 x 2 in. For driving the camshaft, use is made of helical toothed gears, cut with 10 pitch teeth of ⅞ in. face. The pinion on the crankshaft and the magneto driving gear are of steel, while the gear on the camshaft is made of cast iron. The timing gears are inclosed by a malleable iron cover, the hub on which for the crankshaft is turned off cylindrically to form the third point of support for the engine. This cover is held in place rigidly by means of cap screws, lock washers and dowel pins.

Oil is fed to the three main crankshaft bearings under pressure by means of a plunger pump operated from an eccentric on the camshaft. The plunger of this pump, instead of moving in a horizontal plane, has an up and down motion. In addition to supplying oil to the main crankshaft bearings, oil is delivered from this pump to the timing gears, and to the connecting-rod splash troughs. All other interior parts, including the camshaft bearings, pistons, connecting-rod bearings and cylinders, are lubricated by splash. Oil is drawn from the main oil base through a fine mesh screen. The base will hold 5 quarts of oil, and is provided with a positive dial



Cross section through cylinder

indicator showing the oil level. As a precautionary measure, when the gage shows "empty," there is still a certain amount of oil in the base.

The engine is designed to take a standard 1 inch carbureter. Either a horizontal or a vertical outlet carbureter can be used, the vertical outlet type going on the left hand side, and fastening to the inlet manifold, while the horizontal outlet type is placed on the right hand side, and connects directly to the cylinder block. With the horizontal type carbureter the intake passage leads through the space between cylinders Nos. 2 and 3.

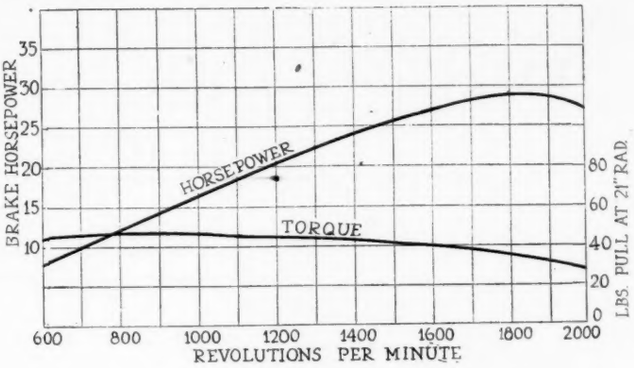
The flywheel is secured to an integral flange of the crankshaft by means of six heat-treated bolts. It is regularly furnished to accommodate standard clutches used in connection with the No. 3 S. A. E. bell housing.

Provision for Electrical Equipment

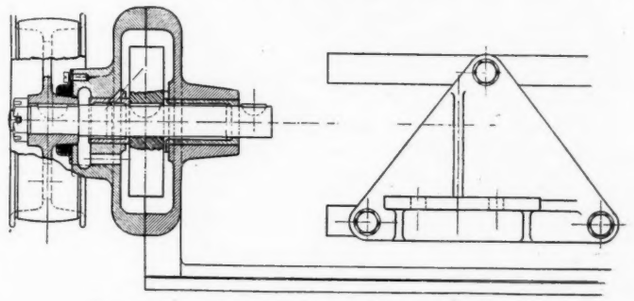
Provision is made for fitting a complete electrical equipment. A starting motor flange is provided on the detachable bell housing, which is of the No. 3 S. A. E. size. An ignition generator or plain lighting generator, a magneto or both can be mounted on the detachable magneto or generator bracket, and can be driven by a standard two bearing magneto shaft and coupling. A bell housing of cast iron is furnished for truck and tractor work, and of aluminum for passenger car work.

The cooling system is designed for thermo-siphon circulation, and the water connections are made appropriately large, the inlet being 2 in. in diameter, and the outlet 2¼ in. A malleable iron adjustable fan bracket is provided. A drop forged steel, quadruple jaw, roller handle crank is furnished with the engine.

The piston displacement of this engine is 192.4 cu. in. and its N. A. C. C. rating is 19.6 hp., while on the dynamometer the engine shows 34.6 hp. A horsepower and torque curve chart is shown herewith. The engine complete with cast iron base and bell housing weighs 495 lb.



Horsepower and torque curves

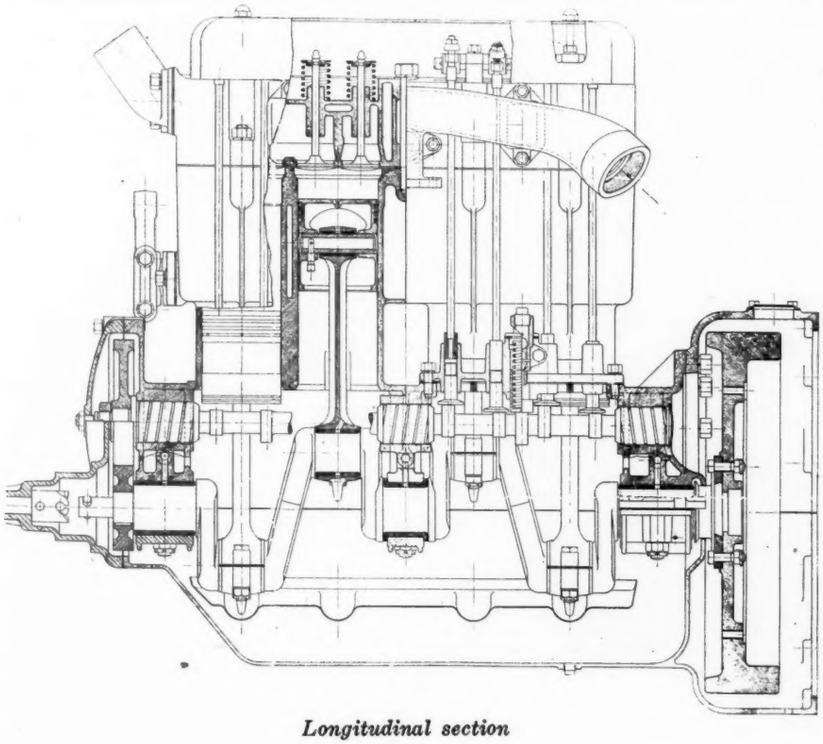


Fan and magneto drive and magneto bracket

Preferential Tariff for Belgium Proposed

AUTOMOBILE travel in Belgium is still full of difficulties. Roads in the devastated area are in terrible condition, being full of holes and most destructive of springs and the general mechanism of the car. Gasoline is only obtainable in a few localities, and its cost is from $1.50 to $2.60 per gal. Tires are rare, a 36-in. casing costing from $100 to $120.

The Belgian Society of Automobile Manufacturers has already held a meeting, at which a committee was elected and new members admitted. Messrs. Gregoire, Deconinck and Dejong were elected as delegates to attend the conference of recognized Syndicates of Automobile Manufacturers at Paris next month. This conference, which will be attended by delegates from England, France, America and Belgium, will consider the advisability of recommending a preferential tariff for Belgian automobile manufacturers who existed before the war, and whose capital is entirely of Belgian origin. The proposal is being made by the British Society of Motor Manufacturers and Traders.



Longitudinal section

Detroit Demands Gasoline Meters

DETROIT, Feb. 10—An ordinance adopted by the common council of Highland Park, a suburb of this city, requires the installation of a meter in every gasoline station showing the consumers how much fuel they are actually receiving.

6140 Motor Vehicles in Switzerland

BERNE, Jan. 5—According to statistics of the Automobile Club of Switzerland, at the end of 1917 there were 6140 motor vehicles in Switzerland, of which 4934 were touring cars and 1206 motor lorries. There were 15 firms in the Helvetic confederation, and these had produced 2565 of the total number, the remaining 3575 representing 43 foreign makes. Fiat was the foreign firm with the largest number of vehicles in Switzerland, 283 touring cars and 15 lorries. Of the foreign nations supplying vehicles France came first, Germany second, America third, Italy fourth and Belgium fifth. British cars were not listed separately.

Douglas Automatic Airplane Ignition Interrupter

A Safety Device Stopping the Engine Instantly When Propeller Breaks or Other Serious Breakage Occurs

BREAKAGE of airplane propellers in flight, or of other important parts, resulting in a seriously unbalanced condition of the power plant, often proves fatal to the pilot. An instrument designed to prevent such results, known as the interrupter, has been invented by Theodore Douglas, president of the Duplex Engine Governor Co., Inc., Brooklyn, N. Y. It was developed under the auspices of the National Advisory Committee for Aeronautics.

The function of the instrument is to automatically interrupt engine ignition, thereby stopping power development, in the event of the propeller breaking, etc. In non-war flying the danger of such breakage is fortunately not serious, though it is always present. Under war conditions, on the other hand, such breakages, accidental or from gun-fire, are very frequent and in a large percentage of cases end fatally.

The tendency of a tractor plane, in the event of its propeller breaking, is to go into a dive, and of a pusher plane to go into a tail-stall. Under such conditions either type of machine is apt to pass into a spin as a result of the unbroken propeller blade tending to swing the machine around a neutral axis. The resulting intense vibration is apt to break a gasoline line, and the continued exhaust of the engine into the gasoline-charged atmosphere may cause a fire. Sometimes the most perfect mental and physical co-ordination on the part of the pilot fails to prevent this, since the brain and hand can seldom act quickly enough, as many thoroughly understood accidents of this nature attest. This manual limitation will be better realized when it is considered that the time of one engine revolution assuming full throttle varies from one twenty-third to one twenty-seventh of a second.

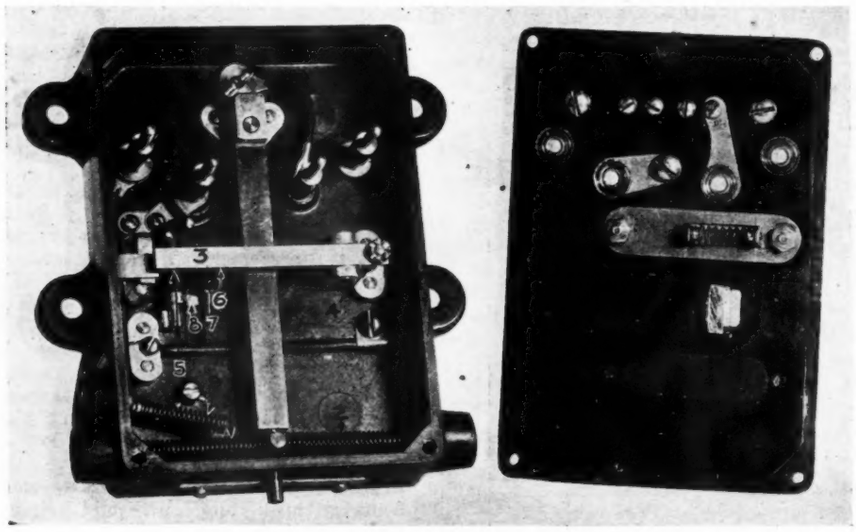
The interrupter supplements the action of the pilot in such instances, and through practically instantaneous action interrupts the power development, thereby confining the danger to the initial breakage. The instrument is thought to be particularly desirable on twin-engine machines, as such an accident happening to one engine would cause the good engine to tend to suddenly swing the machine around and probably into a spin. On such machines the interrupter may be so installed as to instantly cut out both engines, thus maintaining an approximately normal flying position. The pilot then has the alternative of making a landing with dead engines, or of switching off his damaged engine and continuing his flight with his good engine at reduced speed.

The Design

The instrument consists essentially of a suitably pivoted metal bar, so mounted as to swing in a plane transverse to the axis of rotation of the propeller. By means of tension springs 2-2, the free movement of this bar is confined, under normal airplane operating conditions, to a very limited arc in its plane of movement. The amplitude of this movement is determined by the weight of the bar, the intensity and frequency of the transverse vibrations of the engine, and the opposing strength of the springs confining it. The extended end of the trigger 3 is constantly pressed toward the floor of the instrument by the compression spring 4, and is designed to engage the latch 5. On the under side of the trigger 3 there is an inclined surface 6, by which the trigger is raised. A ball-pointed hardened steel screw is fitted into the bar directly beneath the trigger, and is designed to engage an inclined surface and thus to lift the trigger when the swing of the bar is sufficient. When the trigger is lifted the latch 5, held under tension by spring 7, is released and moves out of engagement with the trigger. Cam 8 serves for resetting the latch by rotating it back into position by means of the push button 10 from the outside of the instrument.

The compression spring 9, presenting an unbalanced force, is designed to prevent the bar from disengaging latch 5 as a result of cylinder misses coinciding with bad vibration periods of the engine, etc., thus increasing the amplitude of the swing of the bar through synchronism, or from lateral shocks to which the plane may be subjected in landing. An intense oscillating shock transverse to the axis of the engine, such as an unbalanced engine-propeller torque reaction resulting from the breaking of a propeller at speed, are the kinds of shock intended to operate the instrument, and to which it is claimed to immediately respond. Under such conditions the bar will swing through its full amplitude, raise the trigger, which releases the latch, and thus interrupt the ignition by grounding the magnetos. From the interrupter terminals 11 and 12, wires are connected to the grounding terminals of the magnetos, and from the terminal 13 of the interrupter a wire is connected to the engine ground. On the disengagement of latch 5 a triple contact is made between the interrupter terminals 11, 12 and 13.

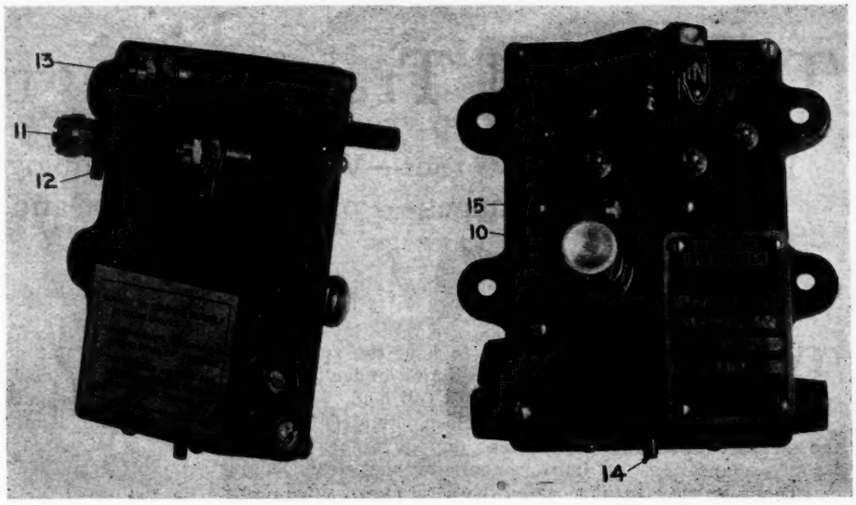
Provision is made to enable the pilot to make a rapid test of the operation of the interrupter before each flight. The handle 14, which projects through a slot in the end of the instrument, is pushed gently to the left until the red spot 15 of the tell-tale,



The interrupter with cover removed

which bears a luminous cross for night flying, appears. Before the engine stops the instrument may be reset by pressing down on the button 10 until the red spot of the tell-tale disappears. Should the engine not stop it would indicate that either the interrupter switch is in the wrong position or that its wiring system, etc., is defective.

A manually operated switch is provided with each instrument by which the interrupter may be thrown into and out of the grounding circuit as desired.



The interrupter complete, front and rear views

Types of Interrupters

Interrupters are furnished of two general types, maker and breaker instruments, and in several models to best suit various engine and airplane conditions.

Maker-instruments, such as the one just described, are intended for magneto ignition engines, in which case there is no flow of current through the instrument, except at the moment of interrupting the ignition.

Breaker-instruments are intended for Liberty engines, using the Delco system, where the current flows constantly through the instrument, and where two separate circuits are provided, because of the double distributer system used on these engines. The interruption of the ignition results from opening these circuits.

Different Models

The interrupter is manufactured in five models, adapting it to the two general ignition systems employed—magneto and battery—and to different engine locations, on the fuselage and in the wings. All instruments are provided with shunting switches. When the engine is located in the wings the interrupter is mounted on a weather-proof casing attached to an engine-bearer, and the shunting switch is located on the instrument board.

The weight of any of the instruments is under ten ounces.

According to the manufacturers, various tests of the interrupter made by the Navy Department have shown in general the following results:

(a) As nearly as it has been possible to determine, the instrument will operate within one complete revolution of the engine following the propeller breakage, or within a time interval of one twenty-third of a second.

(b) It may be depended upon to do this every time that such a breakage occurs, as shown by tests in the air and on the ground.

(c) It will not interfere with the efficiency of the ignition system nor has it caused complications therein of any kind.

(d) The electrical resistance of the interrupter on Liberty engines has been determined by a representative of the Delco company as being less than 0.05 ohm, so the loss of potential in the primary circuit due to it is negligible.

Materials Used for Interrupter

Following are some particulars of materials employed in the construction of the interrupter. The latches and triggers are of hardened steel, heavily silver plated to minimize electrical resistance, to afford better contacts, and to prevent corrosion. Other contact parts are of hard brass, silver or nickel plated. All of the springs employed are of phosphor-bronze.

The electrical connections between the instrument base and its cover are by means of substantial screws which act not only as binding posts, but as attachment members holding the cover in place. These are all protected by castellated nuts and cotter pins. Molded Bakelite insulating parts are used. Owing to the extended development and tests involved the instrument did not get into quantity production until December, 1918.

German Giant Airplanes

A FIVE-ENGINED German bomber was brought down near Talmas on Aug. 10, but unfortunately, owing to the explosion of one of its bombs, the machine was damaged beyond hope of reconstruction. Some of its components have been recovered, and of these, the principal item of interest is the gear box, which is used for all five engines, each of which is a 300-hp. Maybach of the standard 6-cylinder vertical type.

The power plants are arranged as follows: In the nose of the machine is one engine driving a tractor screw. On each side of the fuselage, supported by the wings, is a long pair of engine bearers carrying two engines apiece, which drive tractor and pusher screws. The use of the gear box and driving shafts necessitates the employment of a fly-wheel on the engine, to which is added the female portion of a flexible coupling of the type already described. Whereas the gear box in the 4-engined giant is of a somewhat crude type, employing external driving shafts between the gear box and the engine, in the 5-engined machine the gear box design is considerably improved. The casing consists of a massive aluminum casting provided with four feet, which are bolted to the engine bearers.

Two kinds of gear boxes are employed in these "giants." These differ only in over-all dimensions and the length of the propeller shaft. The larger type is used for the pusher screw in order to obviate the necessity of cutting a slice out of the trailing edge of the main planes. All the gear boxes were very badly damaged except one of the longer type, but it would appear that the shorter design is very similar in appearance. In each case the gear reduction is 21:41. Plain spur pinions are used having a pitch of 22 mm. and a width across the teeth of 75 mm. The diameter of the smaller of the driving pinions is 162.5 mm., and that of the larger pinion 282 mm.

The overall dimensions of the long gear box are as follows: Length, 1025 mm.; breadth, 675 mm.; height, 535 mm. The driving pinion runs on two large diameter roller bearings carried in gun-metal housings supported in the inner end of the gear box. This part is split vertically, and united by the usual transverse bolts. The usual oil-thrower rings of helical type are fitted. At its outer end the pinion shaft terminates in a ring of serrations which engage with serrations provided in the male portion of the flexible coupling, these two parts being held together with bolts and clamping plates.

Truck and Tractor Engine Governors*

Function of the Governor—Various Types Employed, Their Advantages and Disadvantages—Points on Governor and Throttle Design

By R. B. Shoop
Mechanical Engineer, Minneapolis

THE function of a governor is to hold the speed of an engine between predetermined limits under all conditions of operation, from no load to full load.

The history of governors is very closely related to that of the steam engine, and our present day governors are very largely adaptations or improvements of the steam engine governor. James Watt discovered the necessity of some means to regulate the speed of his ponderous, slow moving engine and used the centrifugal type, as shown in Fig. 1.

Tradition has it that the first governor was the result of a boy's desire to play. The old engines had a cord attached to the throttle valve and a boy was employed to watch the speed of the engine and pull the cord when more steam was required. One day this boy yielded to his desire to play and tied two apples to the cord. The scheme worked and the present day governor was born, and some of the present governors, in action, closely resemble that "two-apple" governor.

Classification of Governors

Engine governors can be divided into three classes, as follows:

1—Hit and miss.
2—Throttling.
3—Ignition timing.

In practice, the third class is largely manual in operation, except where mechanical means are provided in the magneto to vary the time of the explosion. This class can be omitted from our discussion.

The hit and miss type is now obsolete in truck and tractor work. This type of governor acted on a pawl or "pick blade," which in turn held the exhaust valve open or the fuel valve closed, allowing a charge of pure air to enter the cylinder, instead of a charge of gas. The throttling governor is now universally used, as modern design has improved the economy of this type to such an extent that the better regulation more than offsets the possible saving in fuel and does away with the trappy devices and irregular explosions of the hit and miss governor.

Both the hit and miss and the throttling mechanical governor may be of one or the other of three types or a combination of two of them, viz.:

1—Centrifugal.
2—Inertia.
3—Pendulum.

The first two will be treated later. The pendulum governor is described by its name and is used largely on the hit and miss type.

Electro-Magnetic Type

The past year has brought us a new type, which we are all watching with deep interest, the electric governor. This device combines the governor, ignition, lighting and starting generator, coil and box, distributor and controller. The direct current generator is a 4 pole shunt wound type. The housing is mounted on trunnion bearings, which allow the generator to turn through an arc of 30 deg. The trunnion bearing shaft is brought through the generator housing and a lever is placed on the outer end. This lever is connected to the throttle valve. The revolving armature produces a magnetic drag on the field frame and causes it to rock on its axis. When the controller is placed in any given position the corresponding speed will be maintained, for if the engine speeds up due to decrease in load, the magnetic drag of the armature on the field is increased, causing the field frame to turn in the direction of armature rotation and close the throttle. If the load is increased the magnetic drag is decreased, allowing the field frame to be turned by a spring, to which is attached a piston operating in a dashpot to prevent too rapid a movement of the arm controlling the throttle valve. A hand wheel on the control box indicates the speed at which the governor holds the engine. The speed range is from 400 to 1650 r.p.m., but the manufacturer will supply the proper speed ratio to hold the engine at any required speed. A starting motor can be used with this device.

Factors Affecting Design

There are a number of variable factors entering into the design of a governor: The work the engine is required to perform, allowable speed variation between no load and full load, size and type of intake control valve, flywheel inertia, vertical or horizontal arrangement, speed, the manufacturing and inspection facilities, and unfortunately, in some cases lack of sufficient space.

If an engine is to do such work as threshing and plowing where there is a sharp rise in the power curve, the weights, springs, rise of governor collar, etc., should be greater than on light work. The weights should be balanced and the springs calibrated so that there is no binding or unequal pressure of moving parts. All moving parts should be inclosed in an oil tight, dust-proof case and should run in an oil bath or vapor. Ball bearings should be used on the principal parts and especially for taking thrust. Some manufacturers even mount the throttle valve on ball bearings.

The main fault of governors, aside from inability to see the approaching hill or the extra bundles thrown into the separator, is the "hunting." This is due to the fact that where there is a change in load, the governor makes an effort to take care of it. The force necessary to start the parts moving is greater than that required to keep them moving, so the throttle overruns its position. This speeds or retards the motor and the reverse action is necessary to maintain an equilibrium. Larger weights with proper springs, proper fitting, balanced throttle valve and anti-friction bearings will all help to overcome this defect.

Mounting of Governor Valve

The best way to mount a governor valve, when separate from the governor proper, is in a cage, as shown in Figs. 6 and 7. This allows a proper correlation of parts without depending on the carbureter and also allows a change in carbureter without disturbing the governor parts.

The governor should be set to run the engine at maximum speed, with the carbureter valve open. The retarding should be done with the carbureter control valve or governor speed controlling device. It is unfortunate that corporal punishment has been revoked in most states, as this should be the penalty for the chap who monkeys with the governor.

In a centrifugal governor, the so-called Watt or flyball type, Fig. 1, we have two or more weights revolving about the center spindle and connected to a sliding sleeve, which is in turn connected to the throttle valve by means of a bell

*Read at the January meeting of the Minneapolis Section of the S. A. E.

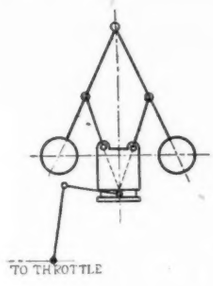


Fig. 1

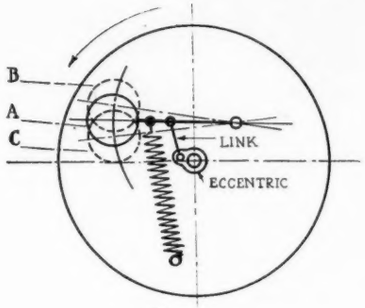


Fig. 2

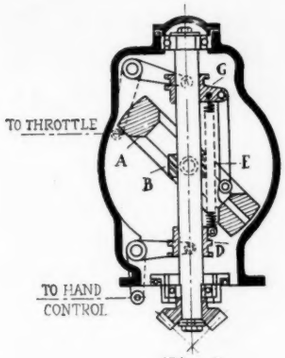


Fig. 3

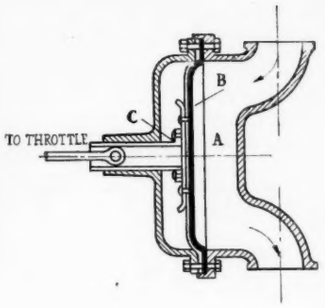


Fig. 4

crank or lever. The proper resistance to the centrifugal force of the balls is maintained by a loaded sleeve, or by springs. The loaded sleeve may be weighted by metal or actuated by a single spring mounted on the spindle or by double springs attached directly to the weights.

One type that is seldom, if ever, used on trucks and tractors is the inertia governor, the reason for its non-use being the difficulty encountered in properly mounting it in the limited space allowed and in balancing its revolving parts.

In a governor of this type the scope of action is a plane perpendicular to the axis of the shaft and the inertia of the weight *A* will make the governor more prompt in its action. If the governor is moving in the direction indicated by the arrow and the load is removed the motor speeds up. The inertia of the weights will hold it back and it will move to position *B*. If the load is suddenly applied, the inertia of *A* will cause it to surge forward to position *B*. This type of governor does not have the "hunting" tendency of the purely centrifugal type.

Adaptation of Marine Type

The ring governor, Fig. 3, was developed by one of the automobile companies and is an adaptation from marine steam engine practice. This is a centrifugal governor, in which the balls are replaced by a metal ring *A* pivoted to the collar *B*, which is mounted on and driven by the spindle. The ring *A* is connected to sliding collar *C*, which actuates the bell crank connected to the throttle by link *E*. There is a lower sliding collar *D* to which is attached the hand control linkage. This is attached to the upper collar *C* by means of a spring. This gives both automatic and manual control and is one form of speed regulator.

The hydraulic governor, Fig. 4, has been successfully used on at least one popular line of trucks. The device is interposed between the pump and motor. It consists of a water chamber *A*, with diaphragm *B* connected to plunger *C* which is attached to the throttle linkage. There is a speed and pressure constant for each motor speed and the diaphragm assumes the proper position for each speed, thus regulating the throttle valve.

Fig. 5 shows an intake governor, or a governor operated by the speed of incoming gases. The floating disk or piston *A*, which is calibrated for a velocity and butterfly friction, by means of side clearance and vertical holes, moves up and down according to the air speed and operates the butterfly *B* through the series of links. The moving parts are made of aluminum for lightness. This governor is interposed between the carbureter and the manifold of the engine.

Among other types of governors are the transmission governor, which regulates the engine speed from the top shaft of the transmission, and the road wheel governor, which is driven from the front wheel by a flexible shaft the same as a speedometer.

An investigation of governors is not complete without study of governor valves. The governor may be attached to the butterfly valve of the carbureter, but a separate valve cage is much better. This allows governor action unhampered by the extra linkage of the manual control. The governor should be set with the engine operating at maximum speed when the carbureter butterfly is wide open. The hand control is attached to the carbureter butterfly and is used for slowing down the engine.

Governor Valve

Fig. 6 shows a widely used type of governor valve. The butterfly is set at 60 deg., but may be set at 90 deg. with the axis, but the working arc is greater with more liability for "hunting," as the valve has to travel further from full closed to any desired area of opening. If the butterfly stem is placed in the center of the valve the pressure of incoming gases on the advancing side is greater than on the opposite side and imposes a greater load on the governor and linkage. This makes for uneven action, and the stem is often offset to

(*Continued on page* 392)

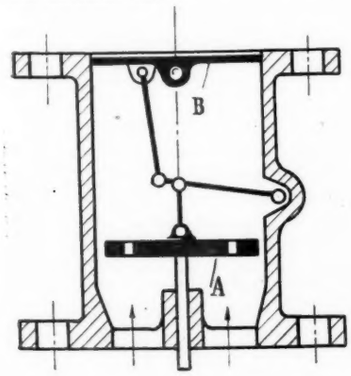


Fig. 5

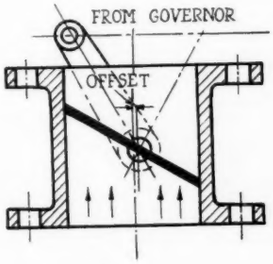


Fig. 6

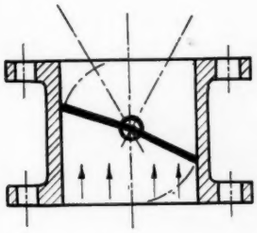


Fig. 7

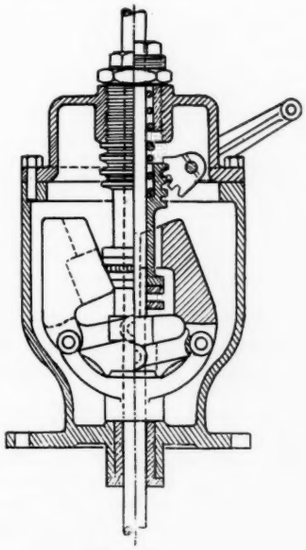


Fig. 8

The Unmined Supply of Petroleum in the United States

(*Continued from page* 361)

Further recent geologic investigations in the field and the study of the results of testing and exploration, especially in the Rock Mountains and Gulf States, have furnished the basis for a more reliable recalculation of the estimates for a number of the regions. The conclusion reached is that the available oil in the ground at the end of 1918 approximates 6,740,000,000 bbl.

Available Oil Remaining in Ground, as Estimated by the U. S. Geological Survey (Bbl. of 42 Gal.)

Oil Fields	Marketed Production in 1917	Marketed Production in 1918 (Preliminary Estimate)	Total Marketed Production to End of 1918	Available Oil Left in Ground, January, 1919	Present Average Gasoline Extraction, Per Cent
Appalachian ...	24,932,205	25,300,000	1,221,737,000	550,000,000	28.0
Lima, Indiana..	3,670,293	3,100,000	448,404,000	40,000,000	28.0
Illinois	15,776,860	13,300,000	298,159,000	175,000,000	22.0
Mid-Continent..	144,043,596	139,600,000	990,573,000	1,725,000,000	24.0
North Texas ...	10,900,646	15,600,000	78,971,000	400,000,000	33.0
North Louisiana.	8,561,963	13,000,000	90,902,000	100,000,000	28.0
Gulf	24,342,879	21,700,000	303,954,000	750,000,000	01.5
Wyoming	8,978,680	12,370,000	39,793,000	400,000,000	40-50
California	93,877,549	101,300,000	1,114,000,000	2,250,000,000	12.0
Alaska, Colorado, Michigan, Montana, etc.	230,930	230,000	10,651,000	350,000,000	....
Total.....	335,315,601	345,500,000	4,598,144,000	6,740,000,000	....

The new estimates, combined according to the commercial fields, are given in the accompanying table, in which for comparison and information are shown the marketed production for 1917 and the estimated output for 1918, as compiled by John D. Northrop, of the Geological Survey, in charge of statistics of petroleum and natural gas, and the approximate total production of petroleum in the United States to the end of 1918, also based on Geological Survey records. For the immediate convenience of the reader there is also included the percentages of average gasoline recovery from the oils of the different fields at the present time. For the later data the writer is indebted to Chester A. Naramore, of the Bureau of Mines, in which bureau the returns of gasoline recovery from the oil runs are compiled. The general characteristics of the various crude oils in the different fields are too well known to require discussion in this paper, and their especial qualities will be fully considered in those to follow. It will, however, be noted that the reserves of the heavy oils of California and the Gulf Coast are estimated at about 3,000,000,000 bbl. Probably such low-gasoline oils comprise more than one-half of the total reserves.

Later Estimates More Reliable

Those who have followed the history of petroleum in America and understand how much of our present-day oilfield development has taken place since Day made his estimates in 1908 and even since Arnold calculated the reserves in 1915 will appreciate the great advantages, mainly in the form of results of exploration and records of production, enjoyed by those who make computations now. However, with these circumstances in mind, we may, nevertheless, for comparison, compensate and bring to date the earlier estimates by deducting subsequent production to the end of 1918. The available oil in the ground at present would be according to these estimates, as follows:

Day (estimate in 1908), 5,402,000,000 to 19,902,000,000 bbl.

Arnold (estimate in 1915), 4,500,000,000 bbl.

Geological Survey (estimate in 1916), 6,647,000,000 bbl.

Geological survey (estimate in January, 1919), 6,740,000,000 bbl.

The recent estimate by the Geological Survey, as given above, and as differentiated by fields in the accompanying table, differs from that of 1916 mainly in a more conservative view as to prospects in Montana and recoveries along the Gulf Coast and in a more optimistic attitude toward Kansas and the States of little or no present production. As compared with the very conservative estimate formulated in the Geological Survey in 1917 they represent greater confidence in Wyoming, north Texas and Alaska and several of the minor States. In general, they are to be regarded as conservative, and there is little probability that the actual yield will fall short of the calculated amounts. They are, however, likely to be again revised in the near future, as the modes of occurrence of oil and gas in different regions become more fully understood, as exploration proceeds, and as the areas offering possibilities of oil discoveries are examined more in detail.

The reports of production of petroleum in the United States, as compiled by the Division of Mineral Resources of the Geological Survey, show that since 1858 approximately 4,598,000,000 bbl. of petroleum has been taken from the ground. This is more than two-thirds as much as the amount which, according to the latest estimate by the Geological Survey, remains available, and exceeds what would now be left according to Arnold. Further, the oil companies are now taking out over one-third of a billion barrels a year.

Relation of Production and Consumption

The situation as to petroleum production and the importance of the remaining oil resources of the United States are both graphically indicated by the curves in the accompanying figure. The most significant features here shown are the steep ascent of the consumption curve and the flattening, in 1918, of the curve of actual production in spite of the vigorous efforts of the oil companies to increase their war-time output even at the expense of their proved reserves. To fill the gap between our actual domestic production and the requirements of domestic consumption it has been necessary to reduce the oil in storage to the extent of 27,000,000 bbl. and to supplement this with a net importation of 31,000,000 bbl., chiefly from Mexico. The deficiency of our current production during 1918 has, therefore, amounted to 58,000,000 bbl., nearly half of which has been withdrawn from storage. That is to say, this country has to the extent of 27,000,000 bbl. of storage oil been "living on its hump," which is now reduced to about 123,000,000 bbl.

According to general expectations, barring disaster or shortage of supply, or much higher prices which might result from such shortage, the consumption curve is destined during the next year, and probably longer, to continue its present general trend beyond the 400,000,000-bbl. mark, which it nearly reached (397,000,000 bbl.) in 1918. On the other hand, whether the domestic production can be increased in volume to correspond to the consumption remains to be seen. Glenn pools and Cushings may await discovery, but the strike of a Glenn pool such as produced the bulge in the storage curve for 1907 and 1908, or of new Healdtons and Cushings, such as were largely responsible for the production swell of 1914-15, will make a less conspicuous wave in the greatly expanded and diffused production of to-day. Texas, the Osage country and Wyoming will furnish notable contributios, but so many fields are now running down that it will require numerous successive strikes of large magnitude to send the production curve so high that oil will go into storage without considerably increased importations. On the whole, even with prices stimulating the driller to greater efforts, it seems unlikely that the domestic production of petroleum can at best gain appreciably on the reasonably expected increase in consumption. It seems more probable that, unless consumption is restrained by high costs, the gap between consumption and production will continue to widen. In any event, this gap must be filled with oil from other sources. Further exhaustion of stocks in 1919 is a certainty that can be successfully minimized only by still larger importations.

The situation demands not only the prevention of waste, but the most economical and efficient use of our oil. Also, it warns operators to consider more thoughtfully and promptly the acquisition of foreign oil reserves. Mexico, to which the American public looks with optimistically hopeful eyes, probably contains less oil—perhaps very much

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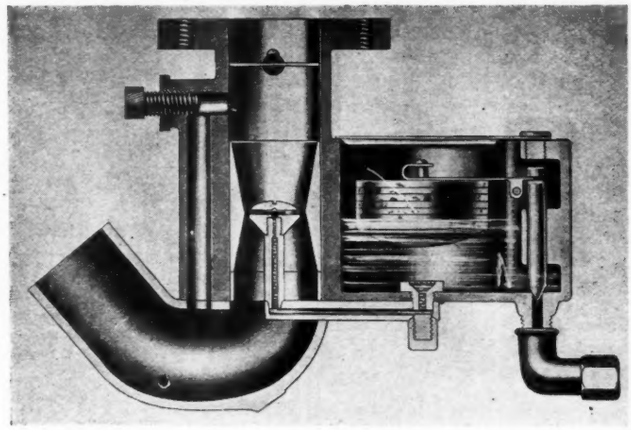
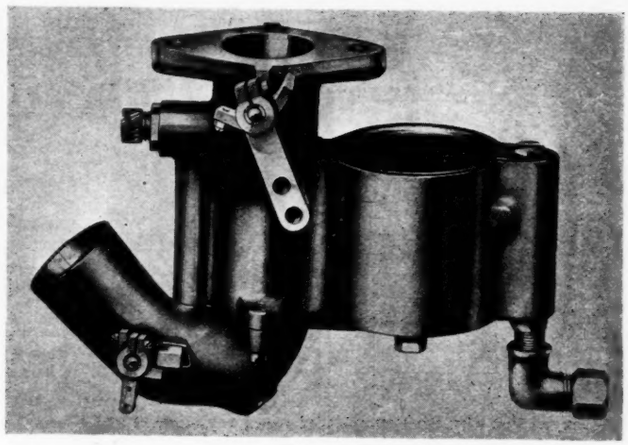


Sectional view through the Sunderman carbureter showing the floating venturi, mushroom jet and air bypass



The new Sunderman carbureter, showing throttle valve, choke valve, air bypass and gasoline connections

New Sunderman Carbureter Uses Floating Venturi

Employs Mushroom Jet and Air Bypass for Regulating Depression at Nozzle

THE Sunderman Corp., Newburgh, N. Y., has brought out a new carbureter which it is marketing under the name of the Nitro. It is a plain tube type, employing a floating venturi and a mushroom nozzle for compensating the ratio of air to gasoline. The nozzle is also relied upon to produce an atomizing effect so that the fuel is reduced to a fine fog before it is mixed with the air.

The floating venturi slides in the jet passage and is concentric with the jet. At idling speeds the float of the venturi is at the jet, while at high speeds it is considerably above the jet, as shown in the diagrammatic illustration herewith. When the venturi rests upon its seat at idling speeds, a very small air passage results which greatly increases the air velocity at the jet, increasing the suction and producing the relatively rich mixture required for idling.

Moderation of the suction on the jet is secured by an adjusting screw which controls an air bypass. This adjustment reduces the suction on the nozzle at lower speeds and consequently reduces the flow of fuel and at the same time prevents the venturi from rising too rapidly. When the throttle is open and the vacuum increased the venturi commences to rise on the air screen and draw away from the nozzle. This opens up the air passage around the nozzle, due to the tapered walls of the venturi, and compensates for correct ratios of air and gasoline. At higher speeds the venturi rises above the air passage, as shown in the diagrammatic illustration. This blocks the passage and puts it out of action, causing all the air to flow through the main passage.

It is claimed that this increases the volumetric efficiency of the engine by giving the maximum air passage. The venturi is a true streamline shape and consequently is designed to give practically no resistance to the free inflow of air while increasing the velocity at its narrow throat. The venturi at all times automatically centers itself on the air screen around the nozzle. It has ample clearance in the carbureter barrel for freedom of motion.

The mushroom nozzle has a calibrated hole drilled in the end of the jet tube to a size suitable for the particular requirements of the engine upon which the carbureter is installed. The jet feeds into the mushroom head and out through four small holes, spreading the gasoline by capillary action. Due to this spreading action it is claimed that the fuel is spread in a thin film to all sides of the under surface of the slot. Here the ascending air picks it off at right angles to its path. The Sunderman Corp. is preparing to turn out this new carbureter for regular equipment by car and truck manufacturers, and will also produce an aluminum model for Ford replacement.

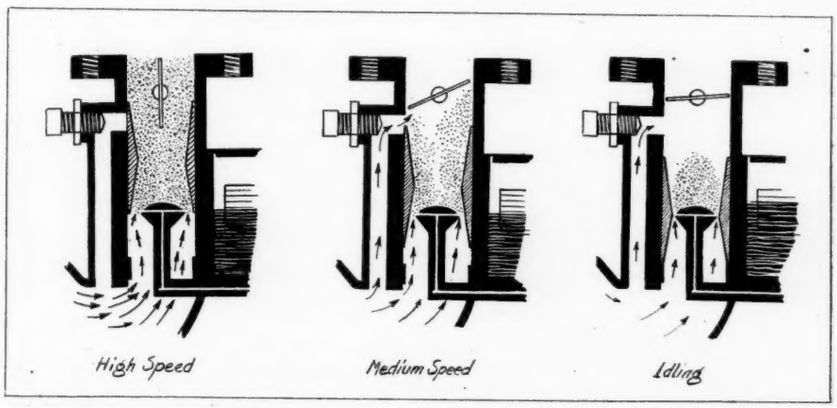


Diagram showing the relationship of the jet, venturi and air bypass in the new Sunderman carbureter at various throttle positions

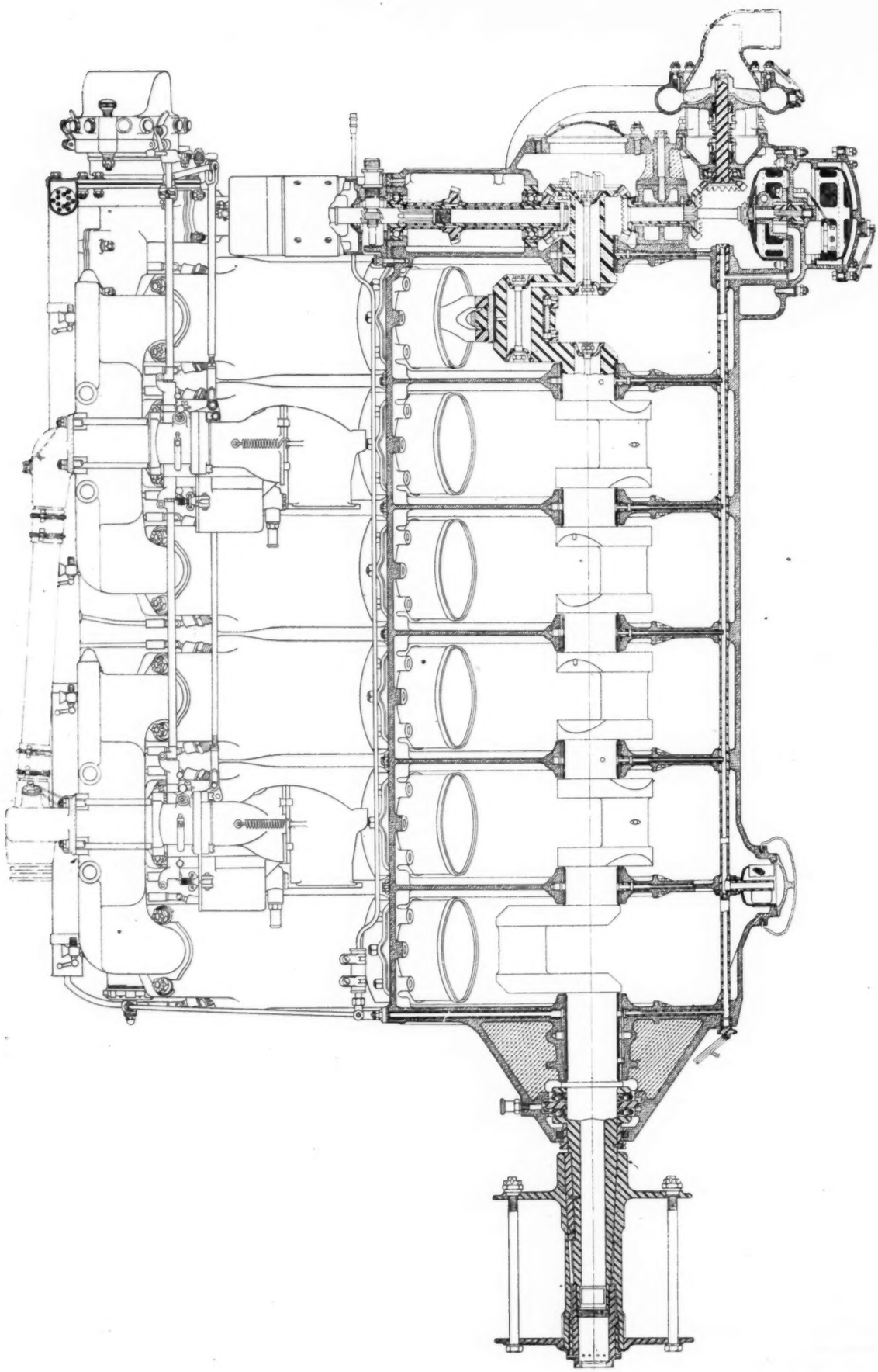


Fig. 1—Longitudinal sectional elevation of Liberty engine

The Liberty Aircraft Engine*

Part II

A Discussion of Various Features of Design, with Reasons for Their Adoption —Performance of Planes Equipped with the Engine

By J. G. Vincent

FIG. 1 clearly indicates the general construction of the conventional type of seven-bearing crankshaft. This type was selected on account of comparatively large bore and stroke of the engine, which made it practically impossible to consider any less number of bearings. No counterweights were considered, because the engine is of the direct-drive type, and not intended to run over 1800 r.p.m. At this speed the main bearing pressures, due to centrifugal force, are not excessive. All main bearings, except the front one, are of the same length, which, of course, results in the bearing pressures being highest on the center bearing. Conservative designs would have dictated a longer center bearing, but as this would have lengthened the engine and added some weight, we decided against it, as calculations and experience indicated that it was not absolutely necessary. Although this center bearing actually showed more wear in service than any of the others, it was never a source of trouble, as the wear was not excessive. From my experience with these engines, I would make the same decision again under the same circumstances, but would lengthen the bearing about 50 per cent, if I were designing an engine for commercial aviation. In this connection I will also state that for a commercial aviation engine I would make all main bearing shells ¼ in. thick, instead of 3/16 in., as is the case in the Liberty.

The crankshaft main bearing journals are all 2⅝ in. in diameter and the crankpins 2⅜ in. The crankshaft cheeks, as originally designed, were the weakest point, and when we began to get into quantity production, small variations in material and heat-treatment occasionally resulted in a broken shaft; sometimes within a few hours and sometimes after from 50 to 100 hr. use. It was, of course, impossible to make the cheek any thicker, and it was, therefore, decided to widen them.

So far as I am aware, no crankshafts of the revised design were ever broken, with the exception of the occasional shaft that contained a flaw, and these usually let go before the engine had passed its manufacturer's test. It is my belief that the crankshaft as strengthened is an entirely practical and satisfactory design for this type and power of engine.

Connecting-Rods

The design of connecting-rods and connecting-rod big end bearings, as originally specified, were on the light side, and while the connecting-rods themselves would stand up indefinitely, if made out of the best material with the best heat-treatment, the least variation would result in trouble. It was, therefore, decided to thicken all sections about 1/32 in., and while this added weight to the engine, it made a thoroughly practical manufacturing proposition.

One of the sources of trouble with the original design was sharp corners under the connecting-rod bolt heads, and this was generously filleted in the redesign. The trouble with the connecting-rod bearings was that they were too thin, with the result that they went out of shape under heavy load, and the continual distortion would crack the babbitt. These bearings would not burn out nor break, but the babbitt would simply disintegrate, with the result that when the engine was taken down after 50-hr. use, the bearings would be in bad shape, and would all have to be replaced. This trouble was entirely overcome by increasing the thickness so that the thinnest portion under the straddle-rod forks is 9/32 in. thick.

The connecting-rods and connecting-rod big end bearings, as finally proved out and standardized, gave a uniformly satisfactory result, and I would not know how to improve them if called upon to do so at this time. We carried out a great many experiments at McCook Field with various kinds of V-type connecting-rods, including the so-called "Marine type," such as is used on the 300-hp. Hispano-Suiza, and the so-called "articulated type," such as is used on the Rolls-Royce. Both of these types can be made perfectly satisfactory, but we could not determine that they were any better than the so-called "straddle-rod type," as standardized for use on the Liberty. The connecting-rod piston-pin bushing, with its splash lubrication, proved entirely satisfactory, which seems to indicate that there is no necessity for carrying pressure oil to the piston pin.

The connecting-rod length to stroke ratio is 1.71 to 1. This proved satisfactory, but I would not recommend designing an aircraft engine with any lower ratio.

Pistons

The die-cast aluminum-alloy piston design, as originally laid down, proved very satisfactory, and was never changed. This piston design was originally dictated by Mr. Hall's experience, as he had proved by extensive experimental work the value of a very thick head and tapered piston wall increasing in thickness toward the top, in order to be as thick back of the piston rings as through the head. The purpose of this thick piston head and tapered wall is, of course, to provide for the proper transfer of heat from the piston head to the cylinder wall.

The piston pin is of the floating type, held in position by aluminum washers pressed into the piston at each side. This construction proved to be very satisfactory and prevented the usual trouble of cotter-pins and set screws dropping into the crankcase.

We had a little trouble at first with the pistons scoring, because they were too soft to work satisfactorily against the steel cylinder. This trouble was quickly cured by making the pistons harder and watching the heat treatment of the cylinders to get them of a uniform hardness, though still machinable.

The crowned head high compression piston gives a compression ratio of 5.4 to 1. The low-compression piston is flat on top but has the same bearing length as the high-compression type. The low-compression piston was used for all navy engines, as they work at comparatively low altitude, and the high-compression for all army engines, as they were intended for use principally at high altitude.

Propeller Hub

As originally designed, the propeller hub was intended to be put on the crankshaft permanently, as it was feared that a detachable hub would give trouble in an engine of so large power. This design, however, was contrary to foreign practice, and so much pressure was brought to bear in favor of the detachable hub that the design was changed before the engine was ordered into production.

*Paper read at the annual meeting of the S. A. E.

Fig. 1 shows the propeller hub as finally designed, including the propeller hub key running clear out to the rear end. The taper is 1 to 12. The propeller hub key as originally put into production was short, and did not extend within 1 in. of the rear end. This construction gave trouble, in that the hub would freeze on the shaft, making it hard to remove and impossible to replace without filing and lapping.

This trouble was largely overcome, and a practical result obtained by extending the key clear to the rear end of the hub and grinding the shaft and hub so that all the draw came at the rear end. By this I mean that the tapers were made so that they did not exactly match, and the front end of the shaft would be perhaps 0.001 in. loose with the rear end drawn up tight. This simply insured that the hub would be absolutely tight at its big or driving end.

The offset hub, as shown in Fig. 1, was really an afterthought to allow room for shutters in front of the radiator, but it proved more satisfactory than the conventional type, due, it is believed, to the reinforcing of the rear flange by the hub extension. The diameters of the propeller hub flanges and bolt circle, as well as the thickness of the propeller hub, proved entirely adequate for the horsepower output of the engine.

Crankcase

As shown in the illustrations, the crankcase is of the deep box-section type; the upper and lower halves being lapped together and firmly anchored to each other by numerous bolts around the flanges, as well as long through bolts on each side of all main bearings. The design of the individual steel cylinders made it possible to extend them down into the crankcase, thus greatly increasing the possible depth and strength of the crankcase, and at the same time making it possible to reduce the included angle between the two rows of cylinders to 45 deg. As clearly indicated, the main bearings are carried between the upper and lower halves. In my opinion, the design of this crankcase had a great deal to do with the satisfactory operation of the Liberty engine, and I know that no other type could be designed anywhere near as light and still stand up.

After the Liberty engine had been in production for some months a well-known English engine expert came to America, and in going over the design of the Liberty engine with me he asked where we got our information as to the design of the crankcase. After I explained its advantages he told me that they were just then beginning to realize the value of the box-section type of crankcase in England, and that experiments carried out recently had proved to them that this type with the bearings carried between halves is a very great improvement over any other design which they had used. The engine-bed flange design, including the number of bolts, form of ribbing, etc., has proved entirely satisfactory.

Cylinders

The individual cylinder design was, of course, originally selected on account of the necessity for a seven-bearing crankshaft, but while the design was being laid down it was recognized that the individual design was right for several other reasons. This design made it possible to machine pilots to extend into the crankcase, thus increasing the depth of the crankcase and making it possible to narrow up the angle without weakening the crankcase too much at the center or having the cylinder flanges overlap. The steel cylinders were selected for this make for more simple machining and easier application of the steel water-jacket. This design also makes for easy assembling and dismantling of the engine, and therefore facilitates manufacture as well as maintenance. It is very convenient to be able to remove a damaged cylinder quickly without disturbing the remainder of the engine and without removing it from the plane. In my opinion, the steel cylinder is the lightest that can be designed, and its construction provides for the best possible valve cooling. In spite of the fact that the Liberty valve is 2½ in. in diameter in the clear, it cools very satisfactorily, and I have seen any number of engines taken down after 100 hr. flying with the valves still in good, serviceable condition. Owing to the shape of the steel water-jacket around the spark plug, considerable difficulty was experienced in producing this stamping, but dies were finally devised which produced a perfect result with the minimum of scrap.

Manufacture of Hollow Forgings

One of the big manufacturing problems in connection with the steel cylinder was to secure hollow forgings of the proper material, which would provide for the minimum removal of material in machining. This job was submitted to two different companies, the Ford Motor Co., Detroit, and the J. G. Brill Co., Philadelphia. Both worked out a thoroughly satisfactory and economical forging. The Ford company worked out a process to make this forging from steel tubing, while the J. G. Brill Co. used a process to make the forgings from billets. One of the difficulties in producing this forging was the fact that its flange is located several inches from the lower end. It is my belief that both companies finally used the same process to produce this flange, consisting of an upsetting operation, with the bore properly reinforced by a pilot.

The valve port cages are machined from separate forgings and welded on, the camshaft housing support bosses being machined as an integral part of these ports. The design is such as to provide for water-cooling for almost the entire length of the exhaust valve stem guide. Proper welding on of the steel jackets proved to be simply a matter of practice to get a good job, and girls were used largely for performing this operation. The only trouble that I have ever heard of in connection with these cylinders was an occasional leak in the water-jackets, which usually occurred at the top of the jacket. This trouble would not occur frequently enough to be of any great importance, but we carried on extensive experimental work, in an endeavor to find out what caused it, and came to the conclusion that it was caused by the flexing of the jacket, due to slight distortion of the cylinder head, under the force of the explosion. If this is a correct deduction there are two ways the trouble could be cured, one being to put a positive tie between the valve ports, and the other to thicken the cylinder head, say 1/16 in.

Camshaft Housing

The camshaft and housing assembly, as well as the valve rocker arms, are clearly shown in Fig. 2. This construction proved to be very satisfactory, as it is positive in operation, practically never gives trouble, is quite easy to assemble and disassemble, and throws very little oil. This is the only type of valve operating mechanism that has given real satisfaction in connection with V-type engines having steel cylinders and exposed valve springs. It is, of course, a much simpler problem to work out a valve-operating mechanism for cast-in-block engines like the Hispano-Suiza, where the entire valve mechanism is covered, and therefore oil-tight.

The arrangement of the driving gears is very clearly indicated in Fig. 1. This arrangement of gearing proved very satisfactory after we had overcome the initial troubles due to bad design, such as lack of proper fillets, metal being cut down too thin under the teeth, etc. During the early manufacture there was a tendency to make these gears too hard.

Some trouble was experienced with the meshing of the bevel gears in the early stages of manufacture, due to the expansion of the crankcase and crankshaft under heat. This trouble was finally overcome by working out the proper clearances and then shimming to that clearance.

The recent Mercedes engines contained a very great improvement, however, at this point. The bevel gear is splined on the crankshaft with a sliding fit, and a separate thrust is provided to locate the gear and determine its mesh. This does away with all variations due to expansion and contraction, and is therefore a great improvement.

Before we had extensive experience with these engines it was predicted that we would have a great deal of trouble from breakage due to crankshaft vibration. I know that the Rolls-Royce company did have serious trouble of this kind, and were forced to put in a compensating spring drive on the crankshaft gear. I believe that we would have had the same trouble with the Liberty had the cylinders been placed at an angle of 60 deg., but due to the 45-deg. angle the periodic vibration seems to be broken up to a marked degree.

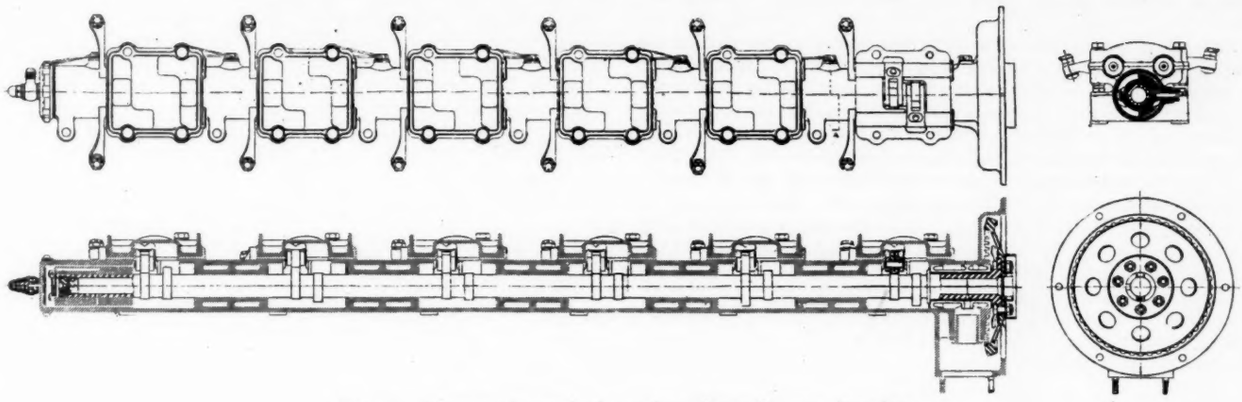


Fig. 2—Plan and vertical section through cam housing

This could, of course, only be proved by building a sample 60-deg. Liberty, but I firmly believe that the 45 deg. allowed us to get by at this point with the simple, light construction.

Lubrication

The double-deck oil pump and pressed-in oil manifolds are shown in Fig. 1. The crankcase is of the dry type, all oil being returned to an outside tank, cooled, and then pumped to the bearings under pressure.

As originally designed, the so-called scupper type of oiling system was provided for the connecting-rod big end bearings. With this system the crank cheeks are not drilled, but part of the oil which works out of the ends of the main bearings is caught by scuppers or scoops and conducted into the large drilled hole through the crank-pin. This system has some very desirable features, among which are simplicity and superior oil economy, and under ordinary conditions it works extremely well, but unfortunately it has one serious drawback. Due to the fact that the large holes through the crank-pins are open, all the oil drains out when the engine is stopped, except in those crank-pins which are near the bottom. This does not make much difference in warm weather, as the oil will quickly flow to the ends of the main bearings, and be caught by the scuppers, when the engine is started, but under cold weather conditions trouble results, and bearings are liable to be burned out, particularly if the throttle is opened quickly after starting. Since this scupper feed oil system had been criticized by foreign engineers, we wasted no time in changing over to the full pressure feed system as soon as the first trouble showed up. Comparatively few engines were manufactured with the scupper feed, and so far as possible all light crankshaft scupper fed engines were kept in this country.

Full Pressure Substituted for Scupper System

After adopting the full pressure feed system no further lubrication trouble was encountered, with the exception of over-oiling of the cylinder and fouling of plugs at high altitudes. This trouble was very largely overcome by drilling a hole in the by-pass valve of such a size as to lower the oil pressure to about 3 to 7 lb. under idling conditions, and still provide 30 to 40 lb. of oil pressure under full load. This device was entirely satisfactory, with the exception that it varied somewhat with different kinds of oil.

At the time the armistice was signed we were experimenting in the air with various kinds of devices inter-connected with the throttle to control the oil pressure positively. This is a comparatively easy thing to design, but we wanted to accomplish the result without making any changes in the basic parts of the Liberty engine. Although this device never got into production, I feel that the principle of positively controlling the oil pressure is correct and should be a part of any aircraft engine design.

Cooling System

The construction of the water pump is clearly shown in Fig. 1. One of the important features of this pump is the automatic spring take-up of the two stuffing boxes, one of which seals the oil in the engine and the other the water in the pump. This construction proved very satisfactory. From an installation point of view, the water-pump is located in a rather bad place, and experience seems to indicate that the best practical place to locate the water-pump is at the bottom of the crankcase near the rear end, in a vertical position, as on the Hispano-Suiza aircraft engine. Nothing which ever has to be got at should be located on the rear end of an aircraft engine, as it is often desirable to locate the engine just in front of a permanent bulkhead. To have located the water-pump as suggested in the Liberty engine it would, of course, have been necessary to have a different arrangement of the oil-pump. The Hispano-Suiza oil-pump is a very satisfactory arrangement, but I prefer that the oil-pump be located so that it can be got at from the bottom or one side of the crankcase, without disturbing the water-pump or any other accessory.

Rumors of Overheating Troubles

Many rumors have been circulated that the Liberty engine is hard to cool, but this is not and never was a fact. We did have two difficulties in connection with cooling the Liberty engine, one being the difficulty which we had in obtaining good tubular radiators, and the other the difficulty involved in working a 400-hp. radiator into the design of a plane which had originally been laid out for 240 hp. We were handicapped by not knowing just how much radiation to provide, as there is a great deal of difference in cooling an engine on the ground and cooling it at 10,000 or 15,000 ft.

We finally adopted the British practice on radiators, as follows: All radiators to be of the tubular type with the ratio between the inside diameter of the tube and its length 1 to 12 desired, and from 1 to 10 to 1 to 14 permissible; the size of the radiator to be determined by the horsepower output on the climb, 0.7 sq. ft. of wetted surface per hp. output being the desired figure. The area of the wetted surface is determined by calculating the outside surface of the tubes, nothing being deducted for the short space taken up at each end by solder:

$$\frac{\pi d l n}{144p} = 0.7$$

Where d = outside diameter of tube in inches
l = length of the tube in inches
n = the number of tubes
p = horsepower on the climb.

This formula has been extensively used, and a radiator designed in accordance with it will give perfect satisfaction on any well-designed aircraft engine, providing the radiator is well made, properly located, and the air flow through it is not badly choked by obstructions.

For military work, shutters must be provided in front of the radiator, so that the pilot can close off the cold air and regulate the temperatures at high altitudes, particularly in cold weather when gliding.

In Fig. 1 the arrangement of the ignition generator is shown, as well as the ignition heads of the Liberty generator type of ignition. The small 10-amp.-hr. battery used in connection with this system can be located in any convenient place about the plane, and the double ignition switch is, of

course, located at a convenient point on the instrument board.

At the time the Liberty engine was designed, so far as we knew, no reliable light-weight twelve-cylinder magnetos were in existence, and we did not want to follow the foreign practice of using four six-cylinder magnetos, not only on account of the weight of the magnetos but also on account of the weight and complications of the necessary drives. Mr. Hall and I have both had extensive experience with the generator type of ignition on aviation engines, and knowing that a light-weight reliable outfit could be secured, we deliberately incorporated it in the design, although we anticipated that we would meet with stubborn resistance from people who had not had experience with this type of ignition. The design, as originally laid down for this engine, proved to be exceedingly satisfactory, and very few changes were made during the early experimental stages.

Ignition Distributor Head

As indicated in the drawings, an ignition distributor head, complete with coil, is located at the rear end of each camshaft housing; each one of these heads is so cross wired as to make it possible to secure ignition in twelve cylinders on either head. thus providing a complete double system.

One of the very desirable features of the Liberty engine which is directly traceable to its ignition, is the easy starting, it being necessary to pull the engine over only very slowly to start it.

My experience would indicate that with a large-bore engine it is much better to start it by pulling it over slowly than on the spark with the starting magneto or vibrator. I believe this is due to the fact that to start on the spark it is necessary to have the mixture just right and on the rich side, and where several attempts are made to start from the spark, excess gasoline often accumulates in the cylinders and cuts the oil off the pistons, due to the large clearances. This is apt to result in scored cylinders.

I think the principal objection to the Liberty ignition system is the location of the ignition heads. They were, of course, placed in their present position to obtain simplicity and light weight, but in some installations they are in the way of a permanent bulkhead, and would be better located if placed at the side. It would, of course, add something to the weight to place them anywhere else, and this is a factor which would have to be taken into consideration. Since the Liberty engine was designed, some very excellent twelve-cylinder magnetos have been developed, and it is entirely possible that in laying out a new design at the present time a magneto installation might be provided which would be just as light and just as reliable as the generator type used on the Liberty. This is a matter which would have to be proved by actual design and exhaustive experimental work.

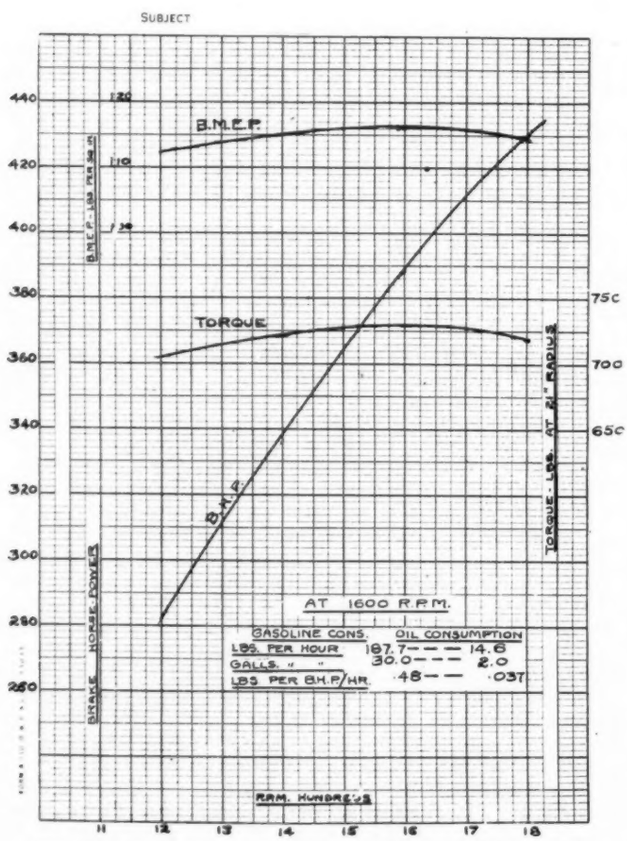


Fig. 3—Performance curves of well worked in twelve-cylinder Liberty engine

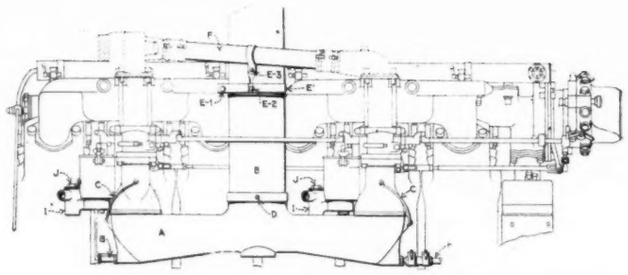


Fig. 4—Longitudinal elevation showing revised carbureter arrangement

Carburetion

At the time the Liberty engine was designed, the only proved-out aircraft carbureter available in this country was the old-style single venturi Zenith, and, although we knew that this carbureter would not be entirely satisfactory, we had to specify it until such time as we could get definite information on something better.

Fig. 1 illustrates the arrangement of the Zenith carbureter, the intake header and water outlet arrangements. It will be noted that four intake headers are used, each serving three cylinders. It will also be noted that hot water is taken out of the top of the cylinders into water-jackets on top of the intake headers and piped from there to the radiator inlet. This arrangement of intake header proved very satisfactory, and resulted in very good distribution at all altitudes. It will be noted that the throttle valves in the carbureter were arranged fore and aft, instead of crosswise, to prevent interfering with the distribution under throttled conditions. This arrangement proved very satisfactory. The altitude adjustment originally provided on these carbureters had very little effect on the mixture, and was, therefore, unsatisfactory.

No strainers were provided in the original carbureter design, as it was thought that a strainer could be provided in a more accessible place. Experience proved this idea to be wrong, as small particles from the rubber hose connections would work into the carbureter and block the jets. This was particularly annoying, as the carbureters are located in an inaccessible place, and it was a considerable job to remove the jets and clean them out.

It will be noted from the drawings that individual air scoops were fitted to each carbureter, and that no provision was made for carrying these intakes outside the bonnet. Although these scoops were drained overboard the drain was only effective with the plane level or climbing, and a flooding carbureter on the glide would spill gasoline over the engine. If backfire occurred after this had happened, the plane might be set on fire. As soon as the engines were received overseas where they had had experience with fires, various modifications were promptly made to reduce the fire hazard, before the planes were flown, and we were requested to change the design as quickly as possible, to overcome this trouble.

While making a change to reduce the fire hazard, we decided to also alter the altitude control and provide screens at the carbureter and beyond all hose connections. Figs. 4 and 5 show the revised construction, which it was intended

should be in all production Jan. 1, 1919. The change in the altitude adjustment consisted simply in some rearrangements of the passages, and the construction, as finally worked out, was so simple as to make it possible to make this change in the field. To provide for a screen, a small aluminum casting *I*, Fig. 4, was provided, and arranged so that it would screw on to the old carbureter. This casting was provided with a nipple to receive the gasoline hose connection, and the screen was easily removable by taking off the nut *J*.

Fire Hazards Reduced

To prevent the possibility of fire, the individual air intakes were removed from the carbureter, as well as their retaining springs, and a single long intake *A* was provided and held on by spring bails *C*. This intake was machined at its center to receive a large single intake pipe *B* extending up through the center of the engine and out through the bonnet. The top end of this pipe was cut off at an angle of 25 deg. A dowel *D* engaged a slot in the intake pipe *B* and prevented it from turning. A clamp band *E* and *E* was arranged to anchor the intake pipe *B* to suitable cap screws already existing in the intake headers. The fragmentary plan view, Fig. 5, shows this rearrangement and the way it is necessary to bend the water outlet pipe to permit the installation of the new intake pipe *B*. The intake header *A* is provided with nipples *G* at each end, so that overflow pipes may be attached and carried outside the fuselage. It is obvious that this provides for the complete draining away of all stray gasoline, whether the plane is climbing, diving or flying level. This new arrangement of altitude control, carbureter screen and intake pipe has been extensively tested out in the air, and has proved to be exceedingly satisfactory.

The revised altitude control was worked out first and went into production in the early summer of 1918, and it is my understanding that all engines were equipped with this improved altitude control before being used at the front. Vague rumors to the effect that the Liberty engine has excessive gasoline consumption have been pretty generally circulated, and this, of course, if true, would be serious. It is obvious that all other things being equal, the gasoline consumption of the engine will be in proportion to the horsepower developed. All well-known aircraft engines at the present time have about the same gasoline consumption per horsepower hour. This runs from 0.48 to 0.56 lb. per b.hp.-hr., depending on conditions. In this respect the Liberty engine is no better, and no worse, than other well-known designs.

Gasoline Consumption

Running wide open near sea level, the Liberty engine will develop 400 to 420 hp. and granting that it develops the average, that is, 410 hp., and that the average service conditions maintain, it will probably have a gasoline consumption of 0.52 lb. per b.hp.-hr. Under these conditions it would burn 213.2 lb., or approximately 35½ gal. per hr. The same engine flying wide open at 15,000 ft. would be developing approximately 295 hp. and if the altitude adjustment was properly used, the gasoline consumption would be reduced in approximately the same ratio. This would bring the consumption down to 153 lb., or roughly 25½ gal. per hr. As a matter of fact, however, the general practice is to throttle down, except for short periods of time when it is desired to obtain maximum speed. Where a plane is capable of making 120 miles per hr. at 15,000 ft. altitude, it is good practice to throttle down to between 90 and 100 miles, thus enormously reducing the horsepower and gasoline consumption per hour, without seriously affecting the distance traveled. We know from practice that with a Liberty twelve mounted in a DeHaviland Four or Nine plane, we can average about 100 miles per hr. in cross-country flying at 15,000 ft. on 20 to 22 gal. of gasoline per hr. Throttling down still more, will further reduce the gasoline consumption, and it is possible to fly a DeHaviland Liberty-equipped plane at about 75 miles per hr. on 17 gal. of gasoline per hr.

Fig. 3 gives absolutely accurate data as to gasoline and oil consumption of Liberty engines running wide open at 1600 r.p.m. near sea level.

Radical Carbureter Design Evolved

A rather radical carbureter design, which was worked out for the Liberty twelve, while only used experimentally, gave some very promising results. Fig. 6 shows this experimental carbureter and intake header arrangement, and Fig. 7 is a fragmentary plan view showing the same arrangement. Fig. 8 is a diagrammatic sectional drawing showing the principal parts of the experimental carbureter. It will be noted that two carbureters are shown, as in the standard Liberty, but they are what might be called an inverted type. Without going into detail as to the construction of this carbureter, it will be noted that the double venturi arrangement, which has been highly developed during the war, makes this construction possible. The reason for this is clearly shown in Fig. 8. It will be noted that this type of carbureter cannot flood into the engine, as would be the case in the ordinary type of carbureter turned upside down. In Fig. 8, *D* is the needle-valve float, *Y* the drain compartment connected to an overflow pipe, *K* the altitude valve, *F* the jet, *N* the compensator well, *M* the compensator feed holes, *I* the compensator, *L* the idling mixture passage, *O* the passage to the secondary choke, and *P* the secondary choke. This arrangement is very desirable for airplane use, as it provides short separate intakes from each carbureter that project directly out through the bonnet and make fire from backfire impossible. Another important advantage of this arrangement is the matter of accessibility, as the carbureters are right up on top of the engine, where all connections and adjustments can easily be gotten at, and it leaves the *V* between the cylinders absolutely clear for machine-gun installation.

It is obvious that this type of carbureter requires a different kind of intake header, and as designed for the experimental job there were rights and lefts, as shown by *A* and *B*. This construction made it necessary to change the water outlet headers, and provide a separate outlet manifold *R* for each line of cylinders. On account of the gas impinging against the bottom of the header in this construction it is necessary to place the water-jackets on the bottom of the intake headers, and to get hot water into these jackets a connection was made at the rear end through the water outlet manifold *R* by the pipe *N* and hose *P*-6. The jackets were connected at the center by the nipples *M* and hose *P*-7. At the front end the jackets were connected to the water manifold *R* by the nipple *M*, hose *P*-1 and pipe *O*. This pipe *O* was arranged to extend inside and then turn forward with the flow to form an ejector and thereby induce some of the hot water to flow through the jackets. This construction worked out very satisfactorily, and the intake header seemed

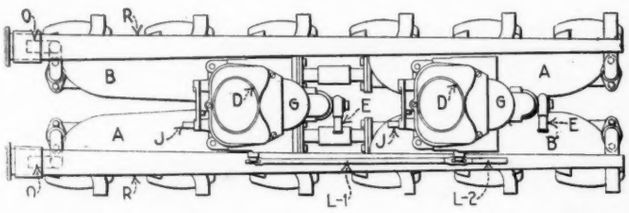


Fig. 5—Plan view of revised intake header arrangement

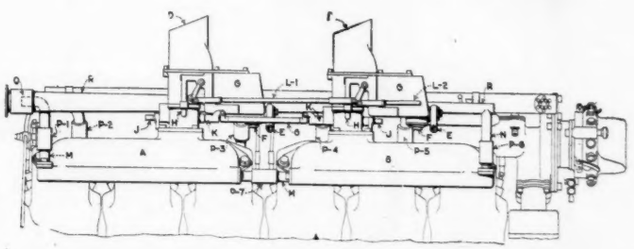


Fig. 6—Longitudinal elevation showing experimental carbureter and intake header arrangement

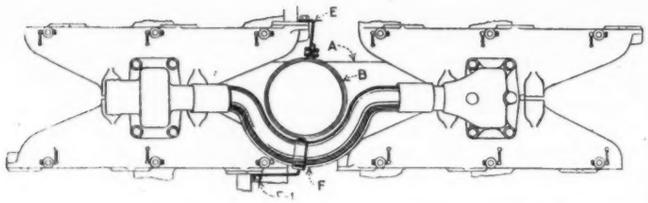


Fig. 7—Fragmentary plan view showing experimental carbureter and intake header arrangement

to keep just as hot as in the standard Liberty construction.

As stated above, this whole inverted carbureter arrangement was treated as a purely experimental proposition, as it was recognized that it would be impossible to put it into production owing to the fact that absolutely new carbureters would require new tooling up as well as many other small parts. I believe, however, that all those who have tested this arrangement believe it to be the best possible installation for the Liberty engine. This carbureter arrangement has every advantage of all such arrangements that I know of, that is, that it does not provide for gravity feed.

Angle Between Cylinders

The Liberty engine has been criticised on account of its cylinders having been set in an inclined angle of 45 deg. All experts in engine design know that a six-cylinder engine is perfectly balanced. Two six-cylinder engines hooked to the same crankshaft are also perfectly balanced at any angle, except as to impulse frequency. Before designing the Liberty engine I had experimented extensively with various angles of cylinders, and knew that the 45-deg. arrangement would not be noticeable, so far as lack of smooth running was concerned, and that it had distinct advantages, not only in that it reduced head resistance, but also that it reduced synchronous vibration of the crankshaft due to the breaking up of the evenly spaced impulses.

The cover over the oil pump in the Liberty engine is held on by a spring bail, which, while readily detachable, cannot jar loose and come off. This is a well-known mechanical device which has been used for years for exactly similar purposes. This little device, however, has been the subject of widely circulated criticism, and I do not know how much it has cost the Government to investigate persistent criticisms on this device sent in by irresponsible people.

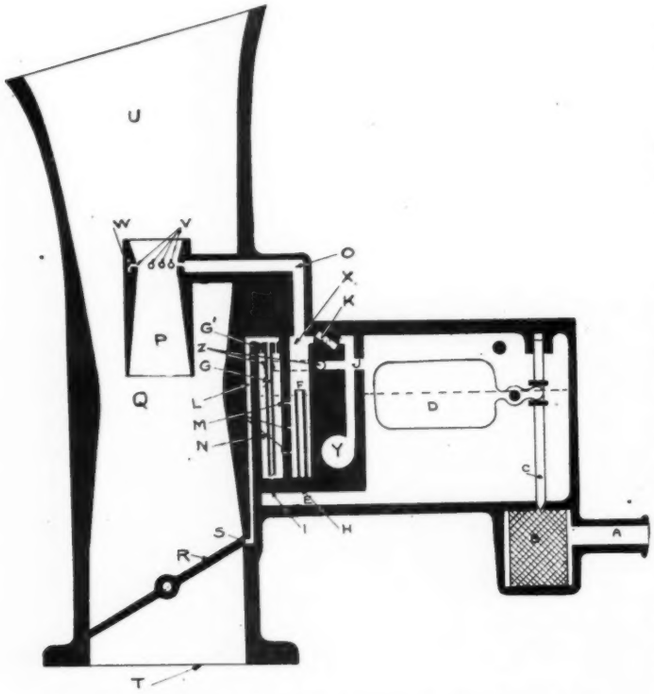


Fig. 8—Sectional diagram of experimental carbureter

Weight Per Horsepower

I believe that it is pretty generally known that the Liberty engine weighs approximately 2 lb. per hp. By using still better materials, making the engine considerably harder to manufacture, and lowering the factor of safety, which is pretty high, it would be possible to bring the weight down to about 1.8 lb. per hp. This would greatly increase production troubles, would require more skilled mechanics to keep it in working order, and would, therefore, in my opinion, be an inadvisable move.

I believe that one of the outstanding features of the Liberty engine, as it is now being manufactured, is its reliability. I have flown the Liberty engine thousands of miles cross-country and have yet to make a forced landing. This reliability has, of course, been developed by extensive experimental work in the air and close attention to details of manufacture and inspection.

Reports have been promiscuously circulated that while the Liberty engine has been proved to be good for large bombing machines it cannot be used in a small, fast fighting or chasse machine. It was never intended that the Liberty twelve should be put in a small, single-seated chasse machine, and that is the reason the Liberty eight was developed. It was our original plan to put the Liberty eight into production and use it for just such small machines, but when our program was finally made up, based on advice from abroad, it did not include a single-seated chasse machine, and for that reason the eight cylinder was not put into production at the time. Some four or five months ago it was decided that we should develop a single-seated chasse machine in this country, and the Liberty eight was promptly brought out and ordered into production. Airplane designers generally agreed that the Liberty eight-cylinder engine, developing as it does 300 hp. and weighing approximately 600 lb., will make a very satisfactory powerplant for a plane of this type.

Air Performance

Owing to the fact that the performance of an airplane must be measured in the air, it is a rather involved matter to make a full flight test, requiring, as it does, a number of special instruments, a well qualified pilot, and proper technical experts to make the necessary corrections for temperature, air density, etc., after the readings have been secured. When we first started making full-flight tests in this country we did not have the proper equipment, and a number of tests were made and reported which were not on a comparative basis with similar tests of allied planes made in Europe. Quite naturally, this has led to a misunderstanding, and it has been claimed that the DeHaviland-Four plane equipped with the Liberty engine, is not as good as allied planes equipped with engines of much less horsepower.

To throw some light on this subject I am giving below a few comparative figures covering foreign planes. They give average performance of three well-known planes, namely: the French Salsom 270 hp., English DH-4, using the Siddeley 240-hp. engine, and the Italian Pomilio E, using the Fiat 240-hp. The USDH-4 is, of course, equipped with the Liberty twelve. The figures on allied planes were secured from official technical reports from abroad and figures on the USDH-4 were taken from tests made by the Technical Section of the Department of Military Aeronautics and the Engineering Division of the Bureau of Aircraft Production.

OBSERVATION PLANE

	Average Foreign	DH-4
Power, hp.	266.6	400
Speed at sea level, miles per hr.	116.8	128
Climb to 10,000 ft.	9¼ min.	7½ min.
Ceiling, ft.	20,267	21,000
Endurance (Cruising)	3½ hr.	4⅓ hr.

DAY BOMBER		
Power, hp.	266.6	400
Speed at sea level, miles per hr.	110.5	118
Climb to 10,000 ft.	11¼ min.	11 min.
Ceiling, ft.	16,000	17,500
Endurance (Cruising)	3½ hr.	4 hr.
Bomb load	423 lb.	223 lb.

RADIUS OF ACTION, MILES	
British DH-9	256
British DH-4	244
Breguet	151
USDH-4	310

In the above comparison it will be noted that the USDH-4 equipped with the Liberty twelve shows up well in all cases except the load of bombs carried as a day bomber. This machine was originally designed for a 240-hp. engine, and when equipped with a slightly heavier 400-hp. Liberty, plus the necessary gasoline for a larger engine, its carrying capacity is naturally cut down. It was to take care of this work that the USD-9-A was being put into production just as the armistice was signed. This machine has 500 sq. ft. of surface and carries 500 lb. of bombs with practically the same performance as the USDH-4. In addition to the USD-9-A, the following planes were being put into production at the time the armistice was signed:

VE-7 advanced training machine, equipped with 150-hp. Hispano-Suiza.

Le Pere two-seated fighting machine, equipped with the Liberty-twelve.

Glenn Martin day or night bombing machine, equipped with two Liberty-twelves.

U. S. Bristol fighting machine, equipped with the Liberty-eight.

Many other new types of planes were in the experimental state, including several designs of single-seated fighting machines around the 300-hp. Hispano and Liberty eight.

The Unmined Supply of Petroleum in the United States

(*Continued from page* 376)

less—than remains in the ground in the United States.

How long the commercial production of natural petroleum will continue in this country is a question whose answer is no less speculative than the quantitative estimates. After the production peak is passed, be it one year or seven, the annual output of natural oil will decline gradually for a long time. Oil wells will be producing at least 75 years hence. The pools cannot all be so soon discovered; the oil cannot immediately be gotten out of the ground. The discovery of deep sands is likely to give new life to many old or even abandoned fields. Pools will be found after prolonged search and repeated wildcatting in old as well as new regions, and this is probably especially true of the Gulf Coast, where, unless geologic discovery and consequent new methods of search, come to the aid of the driller, it may be 75 years before some of the productive salt domes are revealed.

The most significant feature of the prospect, however, is the probability that, although an estimated two-thirds of our reserve is still in the ground, with an annual drain of one-third of a billion barrels, the peak of production will soon be passed—possibly within three years. The date when the peak will be reached is a matter of individual opinion, in which predictions have wide range. There are many well-informed geologists and engineers who believe the peak in the production of natural petroleum in this country will be reached by 1921 and who present impressive evidence that it may come even before 1920.

Development of Oil Shale

In her deposit of oil shale the United States has an anchor to windward. Oil shale is a richly bituminous shale, some of it approaching cannel in character, interbedded, like coal, in series of shales, sandstones and limestones. The most extensive and valuable deposits known in America if not in the whole world are in northeastern Colorado, northeastern Utah and southwestern Wyoming, mainly in what is known as the Uinta Basin. Rich beds of oil shale also occur in very limited areas in northeastern Nevada. Minor deposits, more conveniently located but for the most part leaner and less promising, are found in the Mississippi Valley and the Appalachian States. D. E. Winchester* and A. R. Schultz, of the Geological Survey, have estimated that there are in Colorado, Utah, Wyoming and Nevada deposits of oil shale in thicknesses of 3 ft. or more, and capable of yielding 25 gal. or more of oil per ton, sufficient to produce at least 75,000,000,000 bbl. of oil.

The oil is generated through the destructive distillation of the shale, and its character and composition depend largely on the processes employed. Rough dry or steam distillation tests produce distillates — essentially heavy petroleums — carrying both paraffin and asphalt with considerable nitrogen and yielding gasoline in an average of about 12 per cent. These rough tests indicate that the gasoline obtainable by distillation of these shales, even by simple methods, far exceeds in amount all the petroleum yet produced in the United States and may equal the remaining natural oil.

Shale Oil Production Still Experimental

The production of oil from these shales is still in the experimental stage, in which various methods are being tested. Much doubtless depends on the processes devised and adopted. It is possible that initial commercial success may be determined as much by a study of methods and of the possible by-products and their values as by a further advance in oil prices. The technologic problems connected with the utilization of the oil shales are worthy of research by the best hydrocarbon engineers and chemists.

Shale oil is the most natural, satisfactory and ample substitute for petroleum, and it is likely to come into the market as the production curve of the natural oil glides downward beyond the peak, if not sooner. It must be borne in mind, however, that in spite of the probable very rapid growth of the shale-oil industry beginning with the day that shale oil is produced profitably on a commercial scale, it will require several years to construct and put into operation the enormous plants necessary to treat the millions of tons of shale which must be distilled in order to offset the waning production of natural oil, or fill a part of the gap between the production and consumption of petroleum in the United States.

*U. S. Geological Survey Bulletin No. 641-F, 1917; Bulletin No. 691-B, 1918.

Prevention of Dust on Concrete Floors

IN an article in the *Schweizerische Bauzeitung*, Albert Meyers gives the following method for attaining the above object. It consists in the use of a potash-water glass solution at 40 deg. Baumé in three to four parts of water. The solution is applied with a brush, after the floor has been thoroughly scoured with water and then allowed to dry. After the solution is applied the floor is rubbed over with a wet cloth, and the whole operation repeated. In this way it should be possible to harden the concrete surface considerably and thus prevent dust formation.

Life of Self-Luminous Preparations

MEASUREMENTS carried out by Meitner, extending over a period of seven years, show for six preparations an average life value of 1.905 years, which agree well with the results of other investigators. Measurements effected on an eleven-year-old mesothorium preparation showed the half-value period for mesothorium to be 6.7 years instead of 5.5, which figure had been assumed previously. For thorium, the half-value period was calculated indirectly at 2.37 x 1.10 years.—*Elektrotechnik und Maschinenbau.*

AUTOMOTIVE INDUSTRIES
The Automobile

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Machine Tools at the Show

NOT the least interesting feature of the New York show was the machine tool section in the basement of the Garden. Three complete exhibits of metal working machines were installed, besides a number of exhibits of miscellaneous shop equipment.

The machine tool industry has been engaged to full capacity on equipment for war work production during the past two years. Like certain contingents of our Army, it has been mustered out, and it is now looking for peace-time outlets. And there is probably no branch of industry that offers better chances to the toolmakers than that of automotive equipment. Take, for instance, the tractor branch. Aside from munitions, this has been one of the fastest growing industries in the country during the past two years, having doubled its output each year. The tractor industry has reached the stage where large scale production is about to begin, and this will mean the purchase of a vast amount of shop equipment.

In the automobile and truck industry, while we cannot expect the same rapid growth as in the younger tractor industry, there are also excellent chances for the sale of shop equipment. It is the consensus of opinion among engineers and shop men that the next few years will see progress chiefly in production methods. Automobile design has reached a very high degree of development, and no very striking or radical changes are likely to occur. But with stability in design that firm stands the best chance of success which can produce at the lowest cost. It is on the improvement of production methods that the automobile makers will largely concentrate their efforts during the immediate future, and this will favorably affect the demand for machine tools and other shop equipment.

Tractor Results

ONE of the most striking facts brought out at the S. A. E. session was in relation to the high fuel consumption observed in the British tractor trials. Some four-bottom tractors are said to have used as much as 8 gal. of fuel to the acre. The average consumption as given in one of the papers presented at the meeting was a little over 5 gal.

This is so high in comparison to what we have been getting that it shows the possibility of wide variations. Results in this country seem to indicate that the kerosene consumption per acre may be readily held down to 2 gal. under normal conditions.

When comparing the cost of operating tractor-drawn and horse-drawn farm implements the comparison should not be made solely on the per hour or per mile basis, but should include also a consideration of the element of speed and the fact that the tractor can be utilized to do the work at the time it is required. There is a "best time" for each job to be done on a farm and the tractor is capable of performing these jobs so much faster than horse-drawn implements that each can be performed at its proper time.

As Mr. Kettering pointed out at the S. A. E. meeting, even if the tractor as a whole is a bad mechanical proposition, the farmer cannot afford to throw it out. The filled silo and the bigger farm yield are a direct result of the ability to use the tractor in the short working season. There will be a better return than with horse farming, even if all the rest of the year has to be spent in tuning up the tractor.

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ELECTRIC starting and lighting equipment was almost unknown in Europe previous to the war. It will be next to impossible, however, to sell post-war models there without a complete electrical system. European electrical firms have had little opportunity during the war to develop such equipment and our manufacturers certainly should not miss the opportunity offered them of getting their products taken up abroad. Some of the largest foreign firms, like Fiat and De Dion, have developed their own starting and lighting sets, no doubt because the home market did not offer any suitable equipment.

S. A. E. Fuel Division Needed

A FUEL division is needed in the Society of Automotive Engineers. One could not come away from the winter meeting of the organization without that thought in mind. We have motor car, truck, tractor, airplane and motorboat divisions, but no division to look after automotive interests as regards the fundamental necessity for all the other divisions—fuel.

There should be a vice-president of the fuel division in the same way as there is a vice-president for the other divisions of the organization. He would be able to look after the work which must be done during the next 3 years in meeting the greatest problem which confronts the automotive industry to-day. The problem is a part of two industries, the refineries on one side and the factories which make apparatus using internal combustion engines on the other.

No point of contact has hitherto existed between these industries, and nobody offers a more logical meeting point than the S. A. E. It is a problem that neither industry can solve alone, and it cannot be solved at once. There doubtless must be a transition period where we are changing from one fuel to another. Perhaps certain phases of design must be altered in order to meet the characteristics of the fuel that the refiners would evolve. Perhaps it will be necessary to alter compressions, manifold arrangements, lubricating systems or other details. All these matters would have to be taken into consideration before reaching a conclusion.

It is no simple problem and it cannot be dismissed with the thought that it is only necessary arbitrarily to fix a gravity below that now in use to greatly augment the supply. From the fuel maker's standpoint that would probably settle the problem for a while to come, but from the standpoint of the automotive maker and user the problem would be far from solved.

The car owner wants to be able to start his car on a cold morning. He does not want to have to change the lubricating oil every 3 days as is necessary on some of the farm tractors burning kerosene. Even with the present gasoline the amount of gasoline that enters the crankcase is so large that the life of bearings is seriously menaced if the owner does not take the necessary precautions in regard to changing the lubricant.

Even with the increased gravity of the fuel the question would only be solved from the refiner's standpoint for a relatively short space of time, because the use of automotive apparatus is increasing so rapidly that the problem would soon overtake us again.

The matter is brought squarely back to the engineer and technician in the necessity of producing engines that are more thermally efficient. The average automobile running about the streets with partially closed throttle is getting about 5 per cent of propulsive value out of the engine. The best thermal efficiency in the present type of automobile engine under advantageous circumstances is somewhere around 20 per cent. It does not require any mathematics to prove that this is very wasteful. It would be in the province of the fuel division of the S. A. E. to follow through the development work that is necessary in raising the efficiency of our engines.

Doubling the thermal efficiency of the internal combustion engine is equivalent to doubling the supply of fuel. A car that is now getting 20 miles to the gallon of fuel would get 40 if the thermal efficiency of its engine were raised from the probable figure of 15 per cent up to the possible of 30 per cent. It is easy to realize what a vast increase in our fuel resources would result from an improvement of this nature.

Similarly the ramifications of the problem even reach the building of good roads. It has been found that the consumption of a car going over bad roads can double and even triple that of a car going over the improved roads. Such wide differences in fuel figures have been found in districts where poor roads exist and in those that have the good hard surface roads that, neglecting the matter of time, the roads would be a true economic saving from the fuel standpoint alone.

All of this would be under the control of the vice-president of the fuel division or of the committee having this phase of the work in charge. There is no more vital work that can be undertaken than this. Every branch of the automotive industry is based solely and only upon the internal combustion engine. The internal combustion engine cannot exist without a suitable economical fuel. The present fuel will have to advance radically in price within the next 3 years under present conditions of its use. Now is the time to start work, before we have a real crisis.

Latest News of the

Airplane Show Space Allotted

Fourteen Makers of Planes and Engines and 32 Makers of Accessories Now Listed

NEW YORK, Feb. 11—Plans for the forthcoming aeronautical exposition to be staged by the Manufacturers' Aircraft Association in Madison Square Garden March 1-15 are rapidly assuming shape. At the present time fourteen manufacturers of complete airplanes and engines have been allotted space and thirty-three manufacturers of accessories of various kinds have signified their intention of exhibiting. These exhibits, of course, are in addition to those that will be made by the different army and navy departments. Following is the list of exhibitors to date:

Airplanes and Engines

Dayton Wright Airplane Co., Dayton.
Curtiss Aeroplane & Motor Corp., Buffalo.
L. W. F. Engineering Corp., College Point, L. I.
Wright Martin Aircraft Corp., New Brunswick.
Aeromarine Plane & Motor Co., New York.
Thomas Morse Aircraft Corp., Ithaca.
Burgess Company, Marblehead.
Gallaudet Aircraft Corp., East Greenwich, R. I.
B. F. Sturtevant Co., Jamaica Plain, Boston.
Packard Motor Car Co., Detroit.
Lawrence Aero Engine Corp.
Gio Ansaldo Co.
Cantilever Aero Co., New York.
L. Sperry Aircraft Co., New York.

Accessories

Empire Art Metal Co.; Arthur Johnson Mfg. Co.; Dodge Mfg. Co.; Valentine & Co.; Zenith Carbureter Co.; Wellington, Sears & Co.; John A. Roebling's Sons Co.; Eastman Kodak Co.; Motor Compressor Co.; Gold Light Mfg. Co.; Livingston Radiator Co.
American Balsa Co.; Jones Motrola Co.; Champion Ignition Co.; Dayton Eng. Lab. Co.; Ajax Auto & Sheet Metal Co.; Stone Propeller Co.; Splitdorf Electrical Co.; National Cash Register Co.; Jamestown Propeller Co.
American Propeller & Mfg. Co.; Hartzell Walnut Propeller Co.; Dayton Wire Wheel Co.; Lukenheimer Co.; General Ordnance Co.
Society of Automobile Engineers; Gardner-Moffat Co., Inc.; Torrington Co.; Goodyear Tire & Rubber Co.; Simms Magneto Co.; Triplex Safety Glass Corp.; Radium Dial Co.

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More Men Hired Than Laid Off In Detroit

DETROIT, Feb. 6—The crisis in the labor situation in Detroit has passed. This week more men were hired than were laid off. Over 1000 men have been given employment, while those losing jobs numbered less than 800.

More men were made idle last week than during any other week in recent years. The American Car & Foundry Co. laid off 6000, Lincoln Motor Co. 500, while the Chalmers Motor Co. laid off its entire night shift due to completion of large Government contracts.

There are at present about 35,000 men idle in Detroit. The soldier situation seems to be taking care of itself. Eighty per cent of the men in uniform who registered with the U. S. Employment Office have been placed at work. A feature of the labor situation of late is a noticeable exodus of foreigners. In many local plants foreigners without full citizenship papers are being laid off and their jobs given to soldiers.

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Contract Bill Before House

WASHINGTON, Feb. 11—The long pending bill for validation and settlement of informal war contracts aggregating $3,000,000,000, in which automotive manufacturers are interested to the extent of more than $300,000,000, was agreed upon to-day by the Conference Committee and was placed before the House for final action. The Senate passed the bill last week.

The agreement reached by the Senate and House conferees eliminates the section providing for an appeals commission, and also the McKellar amendment, which would have required War Department officials settling the contracts to make affidavits that they were not connected with any firm or had no personal interest in the contracts under settlement. Otherwise the bill is substantially the same as that passed by the Senate and published in AUTOMOTIVE INDUSTRIES last week.

Under the conference agreement, informal contracts, which include those not legally executed, are legalized so that they may be settled. Government officials will make the settlement and if dissatisfied, contractors may appeal to the Federal Court of Claims.

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Herschell-Spillman Reorganized

NORTH TONAWANDA, N. Y., Feb. 12—The Herschell-Spillman Co. has been reincorporated under laws of Massachusetts with a capitalization of $1,750,000 and has taken over all the assets and property of the old company. Plans for extending the plant and increasing production are under consideration. B. W. Birdsall is president and general manager of the new company and associated with him are: Vice-president and chief engineer, E. O. Spillman; treasurer, Thomas C. Perkins; assistant treasurer and secretary, M. J. Tovell. The directors are T. J. Wilson, chairman; E. O. Spillman, Guy White, F. R. Switzer, Thomas C. Perkins and B. W. Birdsall.

Army Bill Abolishes M. T. C.

Pooling Inefficient and Standardization Lost Under New Bill—Operation and Maintenance Scattered

WASHINGTON, Feb. 12—The Army Appropriation Bill providing for 28,579 officers and 509,909 enlisted men, appropriating $1,117,289,488.56, orders the repeal of the Overman Act under which the Motor Transport Corps, Tank Corps and Aviation Corps were created for the emergency, and by its provisions abolishes the Motor Transport Corps and Tank Corps completely.

The aviation departments, both military and production, are recommended for continuation. The bill provides for the purchase, operation and maintainance of motor trucks and other motor vehicles by each individual army corps, such as the Engineers, Quartermaster, Ordnance and Signal Corps, and thereby reverts back to that condition which existed prior to the war, when the motor transport was not pooled and when each division purchased different types and sizes of vehicles, creating waste, confusion, extravagance and inefficiency, which finally resulted in the creation of a Motor Transport Corps for the purpose of pooling motor vehicles under one body.

Hearings of the House Military Affairs Committee which prompted this act have not been made public, and consequently causes are not available for publication at present.

It is thought in official circles here that either a vital omission was made accidentally on the part of the House Military Affairs Committee in thus scattering the purchase, operation and maintenance of motor vehicles throughout the army or that possibly some influence has brought

(*Continued on page* 395)

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Naval Aviation Approved

WASHINGTON, Feb. 12—The House of Representatives yesterday passed the big Naval Appropriation Bill which includes appropriations for $25,000,000. This sum is for producing, constructing and operating and maintaining aircraft, aircraft stations, aircraft fields and experimental work. No more than $300,000 can be disbursed for drafting, inspection and messenger service for aircraft stations. No part of this appropriation can be expended for the maintenance of more than six heavier-than-air stations on the coasts of continental United States.

Automotive Industries

War Revenue Bill Passes

Measure Taxing Automotive Products Now Goes Before Congress for Approval

WASHINGTON, Feb. 7—The 1919 revenue bill, taxing passenger cars, motor trucks, tires, accessories, parts, truck express and taxicabs, among its numerous provisions, was agreed upon yesterday by the conferees and now comes before Congress for approval. It is anticipated that the bill will be passed promptly as it stands.

The provisions include a tax of 3 per cent on motor trucks, trailers and the equipment, including tires, tubes and other parts; 5 per cent on passenger cars and all other automobiles, including equipment, excepting on tractors, which are not taxed, and 5 per cent on tires, inner tubes, parts and accessories made for automobiles and sold to any person other than an automobile manufacturer. The floor tax on parts originally included is now eliminated. A tax of 1 cent for each 10 cents is assessed on tickets of admission and applies to automobile or parts shows held during the year.

Taxicabs, which includes all automobiles that carry passengers for hire, will pay a tax of $10 with a seating capacity of 7 or less and $20 for those machines with a capacity for more than 7 persons.

The tax of 3 per cent on motor truck haulage where it competes with rail or water transportation of freight remains in the bill, and in addition there is included a tax of 1 cent for each 20 cents paid for motor truck express where it competes with rail or water express, and 8 per cent of the transportation fee for carrying of passengers by motor truck, passenger car or motorcycle when it is in competition with rail or water carriers.

Following are excerpts from the bill, including those provisions most important to the automotive industries:

Sec. 800—That there shall be levied, assessed, collected and paid in lieu of the taxes imposed by section 700 of the Revenue Act of 1917:

(1) A tax of 1 cent for each 10 cents or fraction thereof of the amount paid for admission to any place on or after such date, including admission by season ticket or subscription, to be paid by the person paying for such admission.

Sec. 900. That there shall be levied, assessed, collected and paid upon the following articles sold or leased by the manufacturer, producer, or importer, a tax equivalent to the following percentage of the price paid for which so sold or leased:

(1) Automobile trucks and automobile wagons, including tires, inner tubes, parts and accessories therefor, sold on or in connection therewith or with the sale thereof, 3 per centum;

Provisions in the Revenue Bill

Three per cent tax on motor trucks and trailers.

Five per cent tax on passenger cars.

Five per cent tax on tires, parts, accessories and inner tubes.

Ten per cent tax on shows.

Ten dollars annual tax on taxicabs seating 7 or less.

Twenty dollars annual tax on taxicabs carrying more than 7 persons.

Three per cent of transport cost for freight by truck in competition with rail or water.

Five per cent of transport cost for express by truck or passenger car in competition with rail or water.

Eight per cent of transport fee for carrying passengers by truck, passenger car or motorcycle in competition with rail or water.

(2) Other automobiles and motorcycles, including tires, inner tubes, parts and accessories therefor, sold on or in connection therewith or with the sale thereof, except tractors, 5 per centum;

(3) Tires, inner tubes, parts or accessories for any article enumerated in sub-division (1) or (") sold to any person other than a manufacturer or producer of any of the articles enumerated in sub-division (I) or ("), 5 per centum.

Sec. 1000. That on and after July 1, 1918, in lieu of the tax imposed by the first subdivision of section 407 of the Revenue Act of 1916:

(II) Persons carrying on the business of operating or renting passenger automobiles for hire shall pay $10 for each such automobile having a seating capacity of more than 2 and not more than 7, and $20 for each such automobile having a seating capacity of more than 7.

Sec. 500—That from and after April 1, 1919, there shall be levied, assessed, collected and paid in lieu of the taxes imposed by section 500 of the Revenue Act of 1917:

(*Continued on page* 390)

Continue Rebating Duty on Tractors Valued Under $1,400

OTTAWA, Feb. 10—The Canadian Government has decided to renew the Order-in-Council passed on Feb. 7, last year, rebating the duty on tractors valued at $1,400 and under. These tractors, while practically coming in free, are not on the free list, the duty simply being remitted. The order will be renewed for an indefinite period.

Since duty on tractors of the value specified was removed, over 10,000 of that variety entered the Dominion, and the amount of duty rebated approximated over $2,000,000 for the fiscal year 1916-17. Only about 2000 of all kinds of tractors entered the Dominion previously.

Jobbers Not Guilty of Restraint

21 Members of Automotive Equipment Assn. Freed from Charges

NEW YORK, Feb. 11—The twenty-one members of the Automotive Equipment Association, formerly the National Association of Automobile Accessory Jobbers, and about half as many corporations, have been freed from all charges of monopoly and restraint of trade under the Sherman Law by the jury in the United States District Court for the Southern District of New York. Indications now are that the association will go forward into a successful future. Its growth and activity have been somewhat restricted during the year and a half that the trial has been pending.

The Sherman Law charge has caused the association to be a mysterious quantity in the trade since the finding of the indictment, Aug. 30, 1917. Prospective members have hesitated to join, not knowing what the status of the organization would be.

Judge Hand, in charging the jury, touched on most of the operative resolutions of the association, and stated that of themselves they were not restraint of trade, and that they meant little unless there were some ulterior intent proven.

The association successfully contended that it is not a price-fixing organization and has no monopolistic ambitions. Realizing, however, that some of its motives have been misconstrued, the organization now proposes to give a more definite understanding of its ideals with the object of continuing the trade betterment work it has been doing since its beginning.

The defense used only three witnesses, ex-Presidents Sidney F. Beech, T. M. Brooks and Charles E. Feath, each of whom explained the trade work the association has attempted to perform. Chief among the witnesses for the prosecution were syndicate catalog men, purchasing agencies and others who have had differences with the association's members.

Olds Building 100 Cars Daily

LANSING, Feb. 10—The Olds Motor Works is rapidly swinging into full production with 100 cars and 40 trucks daily. Passenger car production will be run up to 150 machines within 60 days and the daily truck output is being increased.

Rubber Imports 45% of Jan., 1918

Quantity Is Less Than for Same Month in Last Four Years

NEW YORK, Feb. 11—Importations of crude rubber into the United States during January, 1919, amounted to 7235 tons, as against 16,084 tons for January, 1918, and 11,292 tons for December last. This is also less than the imports for any one month during the past year except September and November, during which there were heavy restrictions on raw rubber importation. The present low import figure may be due to the fact that shipping space at the present time is limited for commercial products.

The following statistics for the month of January for four years have been compiled by the Rubber Association of America:

	1916 Tons	1917 Tons	1918 Tons	1919 Tons
January....	9,162	12,788	16,084	7,235

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Labor Surplus Grows

WASHINGTON, Feb. 10—The surplus of labor in the United States is increasing rapidly, according to the U. S. Employment Service of the Department of Labor. Twenty-six states reported a surplus for the week ended Jan. 25, which is an increase of 19 states since Dec. 21.

More than 210,000 workers were unemployed according to reports received last week, while the current week shows a total of 265,000. The number of cities reporting surpluses has increased from 44 to 50 per cent. The number of cities reporting shortages decreased 1 per cent.

Cleveland, with 65,000 surplus, an increase of 10,000 for the week; Detroit, 33,000, as against 20,000 three weeks ago, and Buffalo, with 17,000 surplus, are the three cities reporting the largest surpluses. Akron reports 1500, Dayton 8000 and Toledo 9000 surplus. Reports of surplus workers are also received from California, New York, New England and through the Middle West. Slight shortages are reported from the South.

The total labor shortage of the 18 cities reporting shortages aggregates but 15,000.

The belt of unemployment, beginning in Illinois, extends east through Indiana, Ohio, along the lakes to Buffalo, up into and through Massachusetts; then south along the Atlantic seaboard to Florida and back toward Illinois through Tennessee and Virginia, skipping almost completely the State of Kentucky.

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Two New Nash Models

KENOSHA, WIS., Feb. 10—The Nash Motors Co. has added two models to its line. These are a four-passenger model and a two-passenger roadster. It is expected that first deliveries will be made early in May. The four-passenger model has four doors and is built on a chassis with 121-in. wheelbase, the body having the popular beveled edge. Fenders and running gear are black with nickel plated trimmings. Stock equipment includes wire wheels equipped with cord tires.

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War Revenue Bill Passes

(*Continued from page* 389)

(a) A tax equivalent to 3 per centum of the amount paid for the transportation on or after such date, by rail or water or by any form of mechanical motor power when in competition with carriers by rail or water, of property by freight transported from one point in the United States to another; and a like tax on the amount paid for such transportation which the United States or property transported from a point without the United States to a point within the United States;

(b) A tax of 1 cent for each 20 cents or fraction thereof of the amount paid to any person for the transportation on or after such date by rail or water or by any form of mechanical motor power when in competition with express by rail or water of any package, parcel or shipment by express, transported from one point in the United States to another; and a like tax on the amounts paid for such transportation within the United States of property transported from a point without the United States to a point within the United States;

(c) A tax equivalent to 8 per centum of the amount paid for the transportation on or after such date of persons by rail or water or by any form of mechanical motor power on a regular established line when in competition with carriers by rail or water from one point in the United States to another or to any point in Canada or Mexico where the ticket or order therefor is sold or issued in the United States, not including the amount paid for commutation or season tickets for trips less than 30 miles or for transportation the fare for which does not exceed 42 cents: provided that where such water transportation lines are in competition between American ports with foreign water transportation lines from adjacent foreign ports, the tax imposed under this subdivision of amounts paid for water transportation between American ports shall not exceed the amount of the transportation tax to which such foreign water transportation lines are subjected by their government corresponding to this tax.

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Edmunds & Jones Corp. Has $737,319 Surplus

DETROIT, Feb. 11——For the year ending Dec. 31, the balance sheet of the Edmunds & Jones Corp. and its subsidiaries shows a surplus of $737,319, a decrease of $33,721 over 1917. Comparative figures for the two years follow:

Assets	1918	1917
Real estate, plants, machinery, etc., less reserves	$839,899	$833,083
Patents	1	1
Liberty bonds and other investments	92,619	21,200
Cash on hand and in banks	110,828	47,535
Accounts receivable	208,759	414,228
Inventories	677,834	852,814
Deferred charges	43,451	27,451
	$1,973,392	$2,196,312
Liabilities		
Accounts payable	$331,381	$421,699
Preferred stock	897,500	916,000
Reserve for income and war taxes	6,699	87,573
Uninvested balance of reserve for redemption of preferred stock	492	.....
Surplus — Representing value of 40,000 shares common stock without par value, subject to payment of dividends on preferred stock	737,319	771,040
	$1,973,392	$2,196,312

The annual directors' meeting and the election of officers for the year will take place in about 10 days.

G.M.C. 1918 Surplus $29,940,780

$18,432,388 Increase Over 1917 —The Net Profits Were $19,376,782

PONTIAC, Feb. 10—According to the balance sheet of the General Motors Corp. and subsidiary companies, including five months' operation of Chevrolet, for the 12 months ending Sept. 30, 1918, as compared with that for the 12 months ending Dec. 31, 1917, there is an increase of $18,432,388 in the company's surplus for 1918. The complete statement for the two years is as follows:

Assets	Sept. 30, 1918	Dec. 31, 1917
Real estate, plants, equipment, etc.	$76,144,354	$38,657,835
Good will	.....	11,697,503
Patents, agreements, etc.	245,300	274,100
Investments in allied companies	9,158,730	2,030,273
Cash	23,335,327	18,865,645
Marketable securities	.....	1,255,000
Liberty bonds	10,804,273	.....
Notes and accounts receivable	23,483,734	13,595,538
Inventories	63,864,702	46,559,394
Deferred expenses	1,216,057	854,435
	$208,252,477	$133,789,724

Liabilities	Sept. 30, 1918	Dec. 31, 1917
Preferred stock	$19,684,300	$19,676,800
Common stock	105,996,400	76,873,300
Subsidiary companies' stock and surplus not owned by G. M. Corp.	1,732,339	1,399,583
Accounts and bills payable	13,252,659	10,665,718
Taxes, payroll, etc.	6,253,431	4,858,326
Preferred dividend payable	196,843	196,768
Reserve for depreciation, federal taxes, contingencies, etc.	31,195,725	8,610,936
Surplus	29,940,780	11,508,392
	$208,252,477	$133,789,724

Net profits, after expenses, taxes, depreciation, etc., were deducted, amounted to $35,718,459. After Federal taxes and other expenditures were made, the remaining net profit was $19,376,782. The amount held for outside shareholders was $332,756, the General Motors proportion being $19,044,026. Preferred dividends amounted to $885,769 and undivided profits to $18,158,257. The profit and loss surplus on Jan. 1, 1918, was $11,508,392, with the addition of $8,065,083 through the acquisition of Chevrolet assets on May 2, 1918. With the undivided profits of $18,158,257, the total was $37,731,732. Deducting the common dividend of $7,790,952, the profit and loss surplus amounted to $29,940,700.

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New York Branch for Beckley-Ralston

CHICAGO, Feb. 11—The Beckley-Ralston Co. will shortly open a New York branch at 238-240 West Fifty-fourth Street. The branch is to be headed by James A. Abeles, who has resigned as vice-president and general manager of the Motor Car Equipment Co., New York, and disposed of his interests in that company to take up the new work.

Ford Must Distribute $19,000,000, But May Build Smelting Plant

Michigan Supreme Court Affirms Former Ruling for Distribution to Stockholders—Reverses Decision in Favor of Ford Expansion—Ford-Dodge Case Settles Three Important Points in Michigan Law

LANSING, Feb. 8—The Michigan Supreme Court Friday decided the famous legal action between John and Horace Dodge on one hand and Henry Ford and the Ford Motor Co. on the other. The decision is split, but Mr. Ford carries off the lion's share of the legal score, getting two points to the Dodges' one.

Special dividends, amounting to $19,000,000 were ordered paid to Ford stockholders by Judge Hosmer in the Wayne County Court, and this decree was affirmed. The higher court held that Mr. Ford was arbitrarily usurping the powers of the majority of stockholders, and was in substance making the rights and privileges of the other stockholders incidental to his altruistic plan to let the public have the benefit of company profits in a lower price for automobiles.

Decrees of the Wayne County Courts stopping expansion of the business of the Ford Motor Co. in its extensive smelting plant at River Rouge were overruled. In addition the court sustained the contention of Mr. Ford that the laws of Michigan, when they stop organization of a corporation for over $50,000,000, mean for organization purposes only.

Capital investments, such as the profits, borrowed money, are not controlled by the law limiting capitalization, according to the Supreme Court.

The Court assessed one-third of the cost of the case to Mr. Ford and two-thirds to Dodge Brothers.

The opinion was written by Justice Russell C. Ostrander. It consists of 20,000 words, and quotes at length from the briefs submitted by the attorneys on both sides, from the testimony, from newspaper interviews accredited to Mr. Ford and from letters which passed between the parties at litigation before the actual litigation began.

The case is of great importance to the State at large. It decides three important and perplexing points in Michigan law. These points were the backbone of the case. They are:

1—The rights of minority stockholders in a Michigan corporation.

2—The question whether an automobile company is going beyond the power granted it in the general manufacturing charter by the state, when it engages in the smelting of iron ore for automobile parts.

3—It interprets the meaning of "capital" in the Michigan law which puts a limit of $50,000,000 on a corporation's capitalization.

As to the first point, the court holds that the board of directors of a company must conduct the affairs of the company with the primary object to make money for the stockholders. When, however, the directors, dominated by the majority of the stockholders, apparently operate the corporation for purposes other than making money for the stockholders, they can be and ought to be stopped. They are entitled to retain a reasonable surplus, but when they try to take the profits belonging to the minority stockholders and put them to some other use, they are violating the rights of the minority and the courts can stop them.

Expansion of the business as proposed by Mr. Ford in his smelting plant, however, must not be considered as "some other use," for that expansion is held to be good business.

On the rights of Dodge brothers as stockholders, Justice Ostrander writes:

"It is the contention of the plaintiff (Dodge Brothers) that the apparent effect of the plan (the profit sharing plan with the public) is intended to be continued, and that it is deliberately proposed, not of record, and not by official corporate declaration, but nevertheless proposed, to continue the corporation henceforth as a semi-eleemosynary institution and not as a business institution. In support of this contention they point to the attitude and expressions of Henry Ford.

"Henry Ford is the dominant motor company. No plan of operation could be adopted unless he consented and no board of directors can be elected whom he does not favor. One of the directors of the company has no stock. One share was assigned to him to qualify him for the position, but it is not plain that he owns it.

"The records and especially the testimony of Mr. Ford convince that he has to some extent the attitude toward shareholders of one who has dispensed and distributed to them large gains and that they should be content to take what he chooses to give. His testimony creates the impression, also, that he thinks the Ford Motor Co. has made too much money, has had too large profits and that although large profits might still be earned, a sharing of them with the public, by reducing the price of the output of the company, ought to be undertaken.

"We have no doubt that certain sentimental, philanthropic and altruistic motives creditable to Mr. Ford had large influence in determining the policies to be pursued by the Ford Motor Co., the policy herein referred to.

"There should be no confusion (of which there is evidence) of the duties which Mr. Ford conceives that he and the stockholders owe to the general public and the duties which in law he and his co-directors owe to protesting minority stockholders.

"A business corporation is organized and carried on primarily for the profit of the stockholders. The powers of the directors are to be employed for that end. As we have pointed out, and the proposition does not require argument to sustain it, it is not within the lawful powers of a board of directors to shape and conduct the affairs of a corporation for the merely incidental benefit of shareholders and for the primary purpose of benefiting others, and no one will contend that if the avowed purpose of the defendant directors was to sacrifice the interest of the shareholders, it would not be the duty of the courts to interfere."

That section of the opinion which relates to the smelting works and in which Mr. Ford's plan for that are approved, does not lay down the flat law that an automobile manufacturing concern may go the limit from the transition of the varied raw material into the finished product, but it certainly leans that way. The court, however, notes that there must be special cases where such an argument could be stopped.

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Claims Board Created to Settle War Contracts

WASHINGTON, Feb. 10—A War Department Claims Board has been created by the Secretary of War to supervise and co-ordinate the work of the various War Department agencies engaged in the settlement of claims resulting from the termination of contracts or other procurement obligations made necessary by the suspension of hostilities, and to authorize and approve such settlements. Through special representatives of the board, sitting with the various bureau boards of contract adjustment, the adjustments of the bureaus are subject to its scrutiny and approval. Adjustments involving matters of policy and of particular difficulty and importance are brought before the full board for decision.

The members of the War Department Claims Board are: President, Benedict Crowell, Assistant Secretary of War and Director of Munitions; G. H. Dorr, Assistant Director of Munitions; Brig.-Gen. George W. Burr, Assistant Director of Purchase, Storage and Traffic; Brig.-Gen. Herbert M. Lord, Director of Finance; Lieut.-Col. Herbert H. Lehman, Assistant to the Director of Purchase, Storage and Traffic.

Special members of the board are: W. H. Davis, for Ordnance Department contracts and obligations; Col. C. A. McKenny, for contracts and obligations of the Purchase and Storage Division; Major H. L. Goodhart, for contracts and obligations of the Chemical Warfare Service, Medical Corps and Signal Corps. Other special members may be appointed by the president of the board when necessary in connection with other procurement bureaus or agencies of the War Department.

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Civilian Fliers Require Permits

WASHINGTON, Feb. 10—Civilians will not be permitted to make flights in the Army airplanes, despite the cessation of war activities, without authority from the Secretary of War, according to orders issued to-day by Major General William L. Kenly, Division of Military Aeronautics.

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Hartford Automotive Parts Combines Two Companies

HARTFORD, Feb. 10—Negotiations have been consummated for the consolidation of the Hartford Auto Parts Co. and the Kinsler-Bennett Co., both manufacturers of universal joints and drives. The new company has been incorporated under the name of Hartford Automotive Parts Co., with a capital of $1,500,000. To provide additional manufacturing facilities it has purchased the plant formerly occupied by Billings & Spencer Co., and has taken possession. No change in management is contemplated other than a consolidation of the personnel of those identified with the former companies, and the association of Hollister, White & Co., bankers of Boston, who have a financial interest in the new company. James M. Carney, formerly of the Hartford Auto Parts Co., becomes chairman of the board of the new company, and the following are the officers: President, J. McA. Johnson; vice-president, F. R. Switzer; treasurer, H. A. Bigelow; assistant treasurer, T. C. Hudson. The directors include the above and H. A. Allen of the City Bank & Trust Co., and Shires Morris, president of Hart & Hegeman Co.

To Build a New Truck

NEWARK, OHIO., Feb. 11 — The American Motor Truck Co., a new corporation, is making and will place a new truck on the market within sixty days. The new machine will be made in two sizes, a 1½-ton and a 2-ton machine. Later, a 3½- and a 5-ton truck will be produced, but not before the first of next year. The company will produce 300 trucks this year, the majority of which have already been sold. About a year ago this company purchased the assets of the Blair Motor Truck Co., but it will not make the truck manufactured by the Blair people in the past. Since incorporation, the American Motor Truck Co. has been running 20 hours daily on two-men tanks for the Government. This contract was recently cancelled and the company is now busy tearing out Government machinery and equipping the plant throughout for truck work. The officers of the new concern are: President, J. D. Potter; vice-president and production manager, E. B. Alspach; secretary and treasurer, H. S. McCoy; chief engineer, C. H. Doty, superintendent, H. E. Cavendish.

Henry Vice-President of Maxim Munitions

NEW YORK, Feb. 12—H. H. Henry has been made vice-president and general manager of the Maxim Munitions Corp., 120 Broadway. He was formerly president of the Dart Motor Truck Co., Waterloo, and came East only a few days ago to direct the work of merchandising Maxim tractors along the Atlantic seaboard and abroad.

Trippensee Buys Wolverine Plant

DETROIT, Feb. 11—The Trippensee Mfg. Co., makers of automobile bodies, has bought the plant of the Wolverine Mfg. Co. The property covers 6½ acres with 250,000 ft. floor space with two railroad sidings. The company has already taken possession and it is understood they will commence production at once on closed body work, providing employment for 1600 men.

Harroun Plans for 1919

DETROIT, Feb. 10—The Harroun Motors Corp. is back to 100 per cent peace time production and plans during February to turn out 200 cars, then 500 and gradually increase the number during the spring and summer until the maximum output is reached. The plant is able to make 250 engines and assemble an equal number of cars per day, double shift. The Harroun plant finished its manufacture of shells for the Government on Jan. 31.

Harroun activity for the Government in November showed that 90 per cent of the plant was devoted to shells, 5 per cent to class B truck engines and 3 per cent to Fordson tractors. The whole plant was working on 10,000 tractor shoes, the creeping caterpillar type of walking shoe used as a tread on the wheels of the Government 6-ton tractors. Production of these tractor shoes was about 700 a day. Of the contract for 10,000 cylinder water heads for Fordson tractors, 5000 were turned out on an average of over 100 per day. Notwithstanding Government work, the Harroun plant was able to make 2400 cars from parts on hand.

This concern desires to manufacture its car complete in its own plant as far as possible, and is seeking a body plant, a transmission plant, a universal joint plant and an axle plant, which, when combined with the present plant, will include all the major units necessary for the manufacture of Harroun cars.

Reliance Reorganizes Directorate and Personnel

APPLETON, Feb. 10—The Reliance Motor Truck Co. has reorganized its directorate and official personnel. John M. Balliet, Appleton, has been elected president and general manager, succeeding Ira L. Miller, Racine, who has retired. M. Weyenberg succeeds Mr. Balliet as vice-president. T. F. Purtell, secretary, also has resigned and is succeeded by A. G. Brusewitz, who has been county highway commissioner at Appleton. August Brandt is an additional director. Its new $75,000 plant has been placed in full operation and is manufacturing trucks as well as the former Piggins internal spur-gear drive rear axle for trucks.

Truck and Tractor Engine Governors

(*Continued from page* 375)

equalize this pressure. This offset is governed by the size, angle and gas velocity, but is generally about 1/32 in.

Fig. 7 shows a particular type of disk brought out by one of the large engine manufacturers and serves the same object as offsetting the butterfly stem. The angle on the right is 17 deg. and the left is 25 deg.

There are other types, such as piston valves, gate valves, plates, grids, etc. The piston valve may be balanced but the other types impose more or less extra load on the governor, due to the force of incoming gases. The butterfly valve seems to have the call, as it is serviceable, easily manufactured and installed.

We have now considered some of the elements of a governor. Fig. 8 shows one of the most recent tractor governor designs. This is a very compact, efficient governor, equipped with a simple speed changing device and a spindle spring instead of the double springs frequently used. The governor works through a circular rack and pinion instead of the typical sliding collar.

Fig. 9 shows a complete governor and governor valve installation, as used by one of the largest tractor manufacturers. The weight yoke is bolted directly to the camshaft and the weights operate the spindle *O*, which actuates the governor arm *E*. The casing *F* is bolted to the motor housing and all parts are lubricated from the crankcase. The speed changing device is shown at *J*. The manual control is shown at *W* and is spring mounted.

Commerce Back in Commercial Work

DETROIT, MICH., Feb. 11—The Commerce Truck Co. is winding up its war contract work and is now running approximately 50 per cent on commercial production. Uncompleted Government contracts call for 300 war trucks, but these will be completed within 30 days. This company is now running 15 commercial trucks daily.

Roamer to Make 2000 in 1919

KALAMAZOO, Feb. 11—The Barley Motor Car Co. has been running normal capacity for thirty days, and expects to increase its production 200 per cent within the next months. Four machines are turned out daily. The 1919 production schedule calls for 2000 machines.

Seymour Buys Eisemann

BROOKLYN, N. Y., Feb. 12—The Eisemann Magneto Co. has been sold by the Alien Property Custodian to the Seymour Mfg. Co., Seymour, Conn. This company has been a factor in the brass casting field. It acquires 1500 of the 2000 shares in the Eisemann company, the remaining 500 being retained by R. Kny, president of the Eisemann company. Though nothing definite has been made public regarding the plans of the Seymour company, it is understood that the Eisemann business will be continued.

Airplane Show for Chicago

CHICAGO, Feb. 11—Chicago will hold its first airplane show at the Coliseum, March 29 to April 5. Louis Disbrow is the promoter. He and George W. Browne, Wisconsin distributer for Willys-Overland and distributer in Wisconsin and Illinois for Curtiss, have formed the International Airplane Exposition Co., and may put on similar shows elsewhere. Four Curtiss planes are promised for exhibition. Bart J. Ruddle of Milwaukee, will manage the show.

Mile Record for De Palma

NEW YORK, Feb. 12—Ralph De Palma is reported to have set up a new record for a straight-away mile on Daytona Beach, covering the distance in 24.02 seconds, which is at the rate of 148.875 m.p.h. The kilometer is reported to have been covered in 15.86 seconds. The Contest Board of the American Automobile Association officially observed the trails, but has not yet received confirmation of the time.

Moon Motor Car President Dies

ST. LOUIS, Feb. 12—Joseph W. Moon, president of the Moon Motor Car Co., died last night after a year's illness from hardening of the arteries. He was born in Brown County, Ohio, 66 years ago. In 1882, he came to St. Louis, and, with his brother, J. C. Moon, organized Moon Bros. Carriage Co. Ten years later he formed the Joseph C. Moon Buggy Co., of which he was head. At the time of his death he was also vice-president of the Scheler Implement Co.

197 Exhibitors for Kansas City

Sixty-six Tractors, 131 Accessories Take Space for National Tractor Show

KANSAS CITY, Feb. 10—Arrangements for the National Tractor Show to be held here during the week of Feb. 24 to March 1 are rapidly taking shape, and it is expected that the exhibition will draw a record attendance.

At this time 66 manufacturers of tractors and 131 manufacturers of accessories of various kinds have signed up for space. The following is a partial list of tractor and accessory exhibitors:

Tractors at Kansas City

Acme Harvesting Machine Co.....Peoria
Acme Harvesting Co.....Kansas City
Advance Rumely Thresher Co...Kansas City
Advance Rumely Thresher Co.....LaPorte
Allis-Chalmers Mfg. Co.....Milwaukee
Aultman-Taylor Machinery Co.....Mansfield
Aultman-Taylor Machinery Co..Kansas City
Avery Co. .....Peoria
Automotive Corporation.....Ft. Wayne, Ind.
Bethlehem Motors Co.....Allentown
Bull Tractor Co.....Minneapolis
J. I. Case Plow Works.....Racine
J. I. Case T. M. Co.....Kansas City
Bentley Sales Co.....Kansas City
J. I. Case T. M. Co.....Racine
Cleveland Tractor Co.....Cleveland
Coleman Tractor Co.....Kansas City
Craig Tractor Co.....Cleveland
Culto Tractor Co.....Detroit
Dayton Dick Co.....Quincy
Dart Truck & Tractor Co.....Waterloo
Dougherty Motor Co., H. A.....Kansas City
P. J. Downes Motor Co.....Kansas City
Electric Wheel Co.....Quincy
Emerson-Brantingham Imp. Co.....Rockford
Emerson-Brantingham Imp. Co.Kansas City
Farm Tractor Sales Co.....Kansas City
The Frick Co.....Waynesboro, Pa.
General Motors Co.....Kansas City
Gray Tractor Co.....Minneapolis
Hart-Parr Tractor Co.....Charles City
Henry Ford & Son.....Dearborn
Holt Mfg. Co.....Peoria
Howard Motors Co.....Kansas City
Huber Mfg. Co.....Marion
Illinois Silo & Tractor Co.....Bloomington
International Harvester Co.....Chicago
Janesville Machine Co.....Janesville
John Deere Plow Co.....Moline
John Deere Plow Co.....Kansas City
John Lauson Mfg. Co.....New Holstein
Kansas City Hay Press Co.....Kansas City
Kansas Moline Plow Co.....Kansas City
Kauffman-Parrett Co.....Kansas City
Kinnard & Sons Mfg. Co.....Minneapolis
LaCrosse Tractor Co.....LaCrosse
Liberty Tractor Co.....Minneapolis
Minneapolis Steel & Mach. Co...Minneapolis
Moline Plow Co.....Moline
National Tractor Co.....Cedar Rapids
Nilson Tractor Co.....Minneapolis
G. T. O'Maley Tractor Sales Co..Kansas City
Parrett Tractor Co.....Chicago
Port Huron Engine & Thresher Co.
Port Huron
Rock Island Implement Co.....Kansas City
Rock Island Plow Co.....Rock Island, Ill.
The Russell Co.....Massillon
E. G. Staude Mfg. Co.....Minneapolis
E. G. Staude Mfg. Co.....Kansas City
Simplex Spreader Co.....Kansas City
Trite Tractor Co.....Minneapolis
Turner Mfg. Co.....Port Washington, Wis.
Velie Motors Corporation.....Moline
Wallis Tractor Co.....LaCrosse
Wichita Tractor Co.....Wichita
Wisconsin Farm Tractor Sales Co.,
Madison

Accessories

B. F. Avery & Sons Plow Co....Kansas City
LaCrosse Plow Co.....LaCrosse
Oliver Chilled Plow Co.....South Bend
Parlin & Orendorff Plow Co.....Canton
Roderick Lean Mfg. Co.....Mansfield
South Bend Chilled Plow Co.....South Bend
The Vulcan Plow Co.....Evansville
Columbian Steel Tank Co.....Kansas City
C. A. S. Engineering Co.....Detroit
Link Belt Co.....Chicago
McCord Mfg. Co.....Detroit
Modine Mfg. Co.....Racine
Oakes Co. .....Indianapolis
Perfex Radiator Co.....Racine
Vacuum Oil Co.....Chicago
Gurney Ball Bearing Co.....Jamestown
Hyatt Roller Bearing Co.....Chicago
Lumen Bearing Co.....Buffalo
S. K. F. Administrative Co., Inc...New York
Timken Roller Bearing Co.....Canton
Standard Parts Co.....Cleveland
U. S. Ball Bearing Mfg. Co.....Chicago
Buda Co.....Harvey
Climax Engineering Co.....Clinton
Hercules Motor Co.....Canton
Toro Motor Co.....Minneapolis
Traction Engine Co.....Boyne City
H. J. Walker Co.....Cleveland
Waukesha Motor Co.....Waukesha
American Manganese Steel Co.....Chicago
Balso Oil Co.....Council Bluffs, Ia.
Bates Oil Co.....Council Bluffs
Bosch Magneto Co.....New York
Byrne Kingston Co.....Kokomo
Carnegie Steel Co.....Pittsburgh
Champion Spark Plug Co.....Toledo
Diamond Chain Co.....Indianapolis
Double Seal Ring Co.....Kansas City
Eisemann Magneto Co.....Brooklyn
The Fulton Co.....Knoxville
K. W. Ignition Co.....Cleveland
Indiana Silo Co.....Kansas City
McQuay-Norris Mfg. Co.....St. Louis
Monarch Mfg. Co.....Council Bluffs
Mutual Oil Co.....Kansas City
National Refining Co.....Kansas City
Norma Co. of America.....New York
R. D. Nuttall Co.....Pittsburgh
Remy Electric Co.....Chicago
Splitdorf Electrical Co.....Chicago
Standard Oil Co.....
Sinclair Refining Co.....Kansas City
Tide Water Oil Co.....New York
U. S. Graphite Co.....Saginaw
Willard Storage Battery Co.....Cleveland
Geuder, Paeschke & Frey Co.....Milwaukee
H. R. Mosler Co.....Mt. Vernon, N. Y.
Agrimotor Magazine .....Chicago
Automotive Export Corporation....New York
Clarke Publishing Co.....Madison
The Capper Publications.....Topeka
The Chilton Co.....Philadelphia
The Farm Implement News.....Chicago
Implement & Tractor Trade Journal,
Kansas City
National Farm Power.....Chicago
Sweeney Automobile & Tractor School,
Kansas City
Parlin & Orendorff Plow Co.....Kansas City
Fafnir Bearing Co.....New Britain
American Pulley Co.....Philadelphia
Crew Levick Co.....Philadelphia
Journal of Agriculture.....St. Louis
Grand DeTour Plow Co.....Dixon, Ill.
Farm Machinery, Farm Power.....St. Louis
Madison Kipp Lubricator Co.....Madison
Universal Lug Co.....Cicero, Ill.
Baldwin Chain & Mfg. Co..Worcester, Mass.
Beaver Motor Co.....Kansas City
Stowe Supply Co.....Kansas City
Farm & Fireside.....New York
Joseph Dixon Crucible Co.....New York
W. W. Coates Co.....Kansas City
Oklahoma Farmer Stockman .....Okla. City
Gill Mfg. Co.....Chicago
Acheson Oil-Dag.....Kansas City
Merchant Evans Co.....Philadelphia
Standard Steel Castings Co.....Clearing
Anderson Forge & Machinery Co.....Detroit
Mechanical Belt Co.....St. Joseph
Wood Brothers Thresher Co.....Des Moines
American Fruit Grower.....Chicago
The Moto Meter Co.....New York
Foote Bros. Gear & Mchy Co.....Chicago
American Bronze Corporation...Berwyn, Pa.
Dorr Miller Differential Sales Co...New York
Curtis Publishing Co.....Philadelphia
Hillard Clutch Co.....Elmira
Fedders Mfg. Co.....Buffalo
H. C. Doman Co.....Oshkosh
Hathaway Motor Co.....Kansas City
Rolly Carburetor Co.....Detroit
Rahe Automobile School.. .....Kansas City
The Morgan Corporation, Mfrs.....Chicago
Ajax Auto & Aero Sheet Metal Co..New York
The Sweeney Automobile & Tractor School,
Kansas City
Galion Iron Works & Mfg. Co.....Galion
Shelby Truck & Tractor Co.....Shelby
McCord & Co.....Chicago
Tractor & Trailer.....New York
Howard Motor Co.....Kansas City
Tri State Motor Co.....Kansas City
Power Farming Press. St.....St. Joseph
C. A. Kessler .....St. Joseph
G. T. O'Maley.....Kansas City
Towers & Sullivan.....Rome, Ga.
Illinois Form-A-Truck Co.....Chicago
Rhodes Implement Co.....Kansas City
Society of Automotive Engineers..New York
Bailor Plow Mfg. Co.....Atchison
Mutual Oil Company.....Kansas City
P. & O. Plow Co.....Kansas City
Electric Storage Battery Co. of Phila.,
St. Louis
Taylor Wharton Iron & Steel Co.....Chicago
Indian Refining Co.....Kansas City
Scientific Farming .....Minneapolis
Stromberg Motor Devices.....Chicago

83 French Makers at Lyons Fair

Every Important Maker on List—Little American Representation

PARIS, Jan. 20—Automobile and accessory manufacturers to exhibit at the Lyons samples fair during the first fortnight of March will number eighty-three, according to the final list just published. All these firms will be in one building. The Lyons fair will thus constitute the first automobile show in France since the war.

The list comprises practically every automobile manufacturer of importance in France, including a certain number of newcomers who, before the war, were only indirectly connected with the automobile industry.

There is very little American representation. Goodrich and the United States Rubber Co. will be at the show, and the French agent of the Overland has secured space. Ford does not appear on the official list, but it is believed that its French representative has also reserved space.

It is expected that a number of new cars will be presented at the Lyons fair. The time for preparation is short, but motor men are all working hard to send new types to this exhibition. Where the actual cars cannot be shown, representatives will be on hand to supply information and issue particulars. The fair is open to all but enemy nations.

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U. S. Provided 80 Per Cent of Allied Petroleum Requirements

WASHINGTON, Feb. 8—"If you don't keep up your petroleum system we shall lose the war." This cablegram from Marshal Foch, and a later one reading "Highest command informs that position has become so serious that change in military operations will have to be contemplated unless increased deliveries of gasoline at front are made possible," were given out to-day by the United States Fuel Administration as the real causes for the gasoline-less Sundays of the fall of 1918. The gasoline shortage in France, it is said, was so serious that complete alterations of the campaign would have been necessary had it not been for the timely shipments by the United States, which provided 80 per cent of the Allied requirements of petroleum products during the war.

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N. A. D. A. New St. Louis Address

ST. LOUIS, Feb. 10—The address of the National Automobile Dealers' Association is now 5124 Locust Street. Business Manager Harry G. Moock moved to his new location Friday.

Stover Mfg. Co.....Kansas City
Townsend Mfg. Co.....Janesville
T. E. Bissell Co.....Lockport
Implement Age .....Springfield
H. D. Lee Mercantile Co.....Kansas City

$2,000,000 Asked for Air Mail Service by Assistant Postmaster General

30 Successful Air Mail Routes in Italy, France, Great Britain, Greece, Denmark, Germany, Spain and Austria—Suggests Boston-Atlanta, New York-San Francisco, Key West-Havana Lines

WASHINGTON, Feb. 10—A request for $2,000,000 for the development and extension of air mail routes in the United States was made by Otto Praeger, Second Assistant Postmaster General, in a letter to Congress. The letter, written as an argument in favor of the $850,500 appropriation for air mail contained in the post office bill now before the Senate, stated that 30 airplane mail routes have already been established and successfully operated in Italy, France, Great Britain, Greece, Denmark, Austria, Norway, Spain and Germany, and that many more are contemplated in those countries.

The first route established in the United States between Washington and New York, states the letter, cost $75,165 to operate in the past year as against a revenue of $60,653. The cost as estimated includes a bookkeeping charge of 6 per cent interest on the investment and 33 1/3 per cent depreciation. It was considered an excellent showing in view of the fact that it was the first experiment, and that the route was short and not between two points of high industrial contact. The route was established, says the letter, "not as a typical commercial line, but to solve the problems that had to be met on a daily dependable schedule."

An appropriation of $2,000,000, it was stated, would allow for the establishment of routes between Boston and Atlanta, New York and San Francisco, Key West and Havana, and other points between these cities by means of feeder lines. The War Department planes, and especially those of the De Haviland type, says the post office, are unsuited for mail work. New planes are needed. This accounts for the large sum asked.

Following is the complete statement:

Memorandum on Aerial Mail Service

January 30, 1919.

The Aerial Mail Service was inaugurated May 15, 1918, and during the first six months of its existence its operations covered 68,892 miles, at a cost of $75,165.94, including 6 per cent on investment and 33⅓ per cent for depreciation. In that period it carried between Washington and New York 7452½ pounds of aeroplane mail. The revenue derived was $60,653.28. The net deficit, not taking into account the 6 per cent interest on investment, was $8,969.08. In addition to the aeroplane mail carried there was dispatched between Washington, Philadelphia, and New York in the six months' period a total of 21,926½ pounds of first-class mail, aggregating 3,667,040 letters. This mail was advanced in dispatch from 6 to 16 hours, which many times made up for the small deficit in operation of this service. This ordinary mail was letter mail from distant States, which was carried in addition to the aeroplane mail. Thus the ordinary mail put on the planes at Washington was usually mail from the South Atlantic Coast States and the Gulf States, distributed to carriers by the Railway Mail Service before reaching Washington, and by reason of aeroplane dispatch was delivered in New York on the same afternoon instead of the following morning.

The Washington-New York route was established not as a typical commercial line, but to solve the problems that had to be met to establish a daily dependable schedule. The flying record made on the New York-Washington line has never been equaled in the history of aviation, and its operation by civilian fliers of the Post Office Department has far exceeded its operation while under military control, the civilian fliers having a record of but 7 forced landings in 100 consecutive flights and only 2 failures in that time on account of fog or storm conditions. The mail has been carried in blinding rain and hail, on fog-bound days with visibility of not over half a mile, and in the face of gales. Only two winter gales were strong enough to prevent the aeroplanes from completing their journey. On Thursday, January 23, the mail was brought south as far as Silverside, Del., in the face of a 65-mile gale at an altitude of a few thousand feet.

The fastest time of flight carrying the mail from College Park to Belmont Park, N. Y., a distance of 218 miles, was 1 hour and 30 minutes, and the slowest time for a continuous flight was 4 hours and 56 minutes. The average time is 2 hours and 40 minutes. The common experience of the users of aeroplane mail is that a letter posted in the down-town stations in Washington as late at 10.50 a. m., and leaving the aviation field at 11.30 a. m., is usually delivered between 4 and 4.30 in the afternoon, which is ample time before close of business.

Extension of Service

The greater the distance between the points on an aerial mail route the greater is the service rendered to commerce and the greater is the patronage of the line. A mail service leaving New York at 6 in the morning and arriving in Chicago before 3 o'clock in the afternoon, in time to connect with carrier deliveries, will advance the mail between the two cities by 16 hours over any train dispatch that can be made after the departure of the Twentieth Century Limited from New York at 2.45 p. m. The department desires to establish this line immediately and extend it west to the foot of the Rockies during the coming fiscal year, with the view of reaching the seaports of Seattle and San Francisco, if Congress authorizes the appropriation necessary. The air mail time between New York and San Francisco will be less than 40 hours. It is desired that this transcontinental trunk line shall be tapped by lines from Minneapolis, St. Paul, St. Louis, Kansas City and other points, and ultimately by a line from Boston, via Albany, Buffalo and Detroit, to Chicago.

A north and south trunk line from Boston to Atlanta should likewise be established, with an ultimate extension from Boston to Montreal, Canada, and from Atlanta, via Key West, to Habana. Based on the accurate cost accounting kept in the operation of the Washington-New York air mail line, the cost of an east and west trunk line from New York as far west as Omaha and a north and south trunk line from Boston to Atlanta has been carefully estimated at $1,600,000. To this should be added $400,000 for several essential feeders that would connect up Detroit, Minneapolis and St. Paul, St. Louis, Kansas City and other points, and would admit of an extension as far west as Salt Lake City, this extension, however, dependent upon the extent to which the Government equipment can be transformed into strong and safe mail-carrying machines.

For this reason it would be very desirable to obtain an appropriation of $2,000,000 for the ensuing fiscal year.

Equipment

The Post Office Department has made a sincere effort to comply with the general and natural sentiment that the war planes left over at the conclusion of hostilities should be utilized in carrying the mails. The attempt at once developed that the DH-4's, of which more than 1000 are said to be available, are too lightly built for commercial work. They were produced in immense haste for light war purposes, to rise from a prepared field, drop a certain number of bombs, fire machine-gun ammunition, and return to a prepared aerodrome empty. When required to make forced landings because of engine trouble they crumple up in a majority of cases, frequently crippling or killing the pilot. The single casualty and the single case of serious physical injury sustained in the operation of the aerial mail service in this country, covering 93,463 miles of operation, were sustained in the persistent and conscientious effort made by the Post Office Department to utilize the DH-4 for cross-country commercial work. Single-motor planes must be expected to occasionally develop engine trouble, which necessitates a forced landing for readjustments. These forced landings must be frequently made over fields that are soft from rain or with holes, gulleys, or small obstructions that will turn a plane upon its back while coming to a stop on the ground. Whenever this occurs to a strong commercial machine, such as is used on the New York-Washington run, the damage is usually slight and the delay not serious.

However, when a DH turns turtle in such landings, it generally sustains more serious injury. In a majority of the cases it fairly crumples up, resulting in bad spills or injury for the pilots. This is the result of the light construction of the planes, which makes them unavailable except possibly for the special war purposes for which they were designed.

There are also in this country, which might be available for mail service, a number of twin-motor Handley-Pages. These planes are of a slow type, with an average speed loaded of from 70 to 90 miles, according to the characteristics of the individual plane. It requires the two engines to keep it in the air with a load, the result being that with one engine getting out of order the twin-motored Handley-Page of the type that was built in this country will come to the ground, although the other engine is intact and operating under full power.

Just as the war was coming to a close certain American manufacturers created twin-motor planes which surpassed anything in that line on the battle front. These planes have sufficient speed to make better than fast railroad time against the severest windstorms; also they can continue on their course in the air with a load against head winds with one engine operating. They can be built strong enough for commercial purposes and will prove satisfactory mail machines.

In the expenditure of any appropriation made by Congress it would be the policy of the Post Office Department first to use such of the De Haviland machines as can be rebuilt and strengthened with reasonable cost. A rebuilt plane of this character has been completed and is undergoing tests to ascertain whether it will be a dependable and safe machine. The services of some of the best aeronautical engineers of the country generously have been placed at the command of the Post Office Department to assist in solving the problem of making the surplus war planes suitable for commercial cross-country work. Should all these efforts fail to develop out of the war material a practical mail-carrying machine, it would be the purpose of the Post Office Department to call upon manufacturers for designs and bids for a commercial twin-motor machine of reasonable cost for carrying the mails. It is believed that with readjusted conditions in the aircraft industry with the cessation of war orders it will be possible to obtain such machines for considerably less than $20,000 by utilizing surplus parts and engines which the War Department has put at the disposal of the Post Office Department.

Army Co-operation

It has always been the policy of the Post Office Department to seek the fullest co-operation with the Army and Navy Departments in their training programs, so that the military personnel and equipment used in military training might incidentally render a civic function in carrying the mails. The Post Office Department has offered to take details of Army fliers and Army mechanics and to utilize war equipment in carrying the mails to such an extent as the military authorities may deem the practice gained by its personnel in the mail service of training value. In this co-operation the Post Office Department has pointed out that the maintenance of mail schedules must be the prime consideration, and that this can be obtained only through placing the men detailed to the Post Office Department under the direction and control of the Postmaster General during the period of such detail. The service can be operated from the standpoint of maintaining mail schedules more efficiently by the Post Office Department. Likewise

the service can be operated at a much less cost to the Government by the Post Office Department than it can be operated by a military branch, notwithstanding the higher wages paid to civilian aviators and mechanics, for the reason that it is the policy in the military branches to be more lavish with men and materials than obtains in civilian operations.

The extent of the expansion of the aerial mail program in this country will naturally depend upon the amount of co-operation that the military authorities may finally determine would be of value in their air training program. This factor, however, is a matter of uncertainty, and it is therefore desirable that Congress should make an appropriation of at least $2,000,000 that a substantial aerial mail service may be inaugurated, independent of the final determination of the military authorities as to the value and the extent of utilizing the aerial mail service as an adjunct to their training program. If this is not done it is probable that this country at the end of a year will find itself as far behind in the commercial development of aviation as it found itself in military aviation upon entry into the recent war.

OTTO PRAEGER,
Second Assistant Postmaster General.

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Italy's Truck Exports Decline in 1918

NEW YORK, Feb. 10—Italian motor vehicle exports showed a falling off for the first six months of 1918, compared with the corresponding period of the two preceding years. From Jan. 1 to June 30, 1918, there were exported a total of 2356 trucks and touring cars, having a total value of approximately $7,000,000, compared with a total of 4148 vehicles in 1917 and 2731 in 1916. The number of touring cars exported during the first six months of 1918 was 728, this constituting a record, for the figures of the two preceding years were 244 and 569 respectively. The decrease was on the trucks, which dropped from the high figure of 3904 for the first half of 1917 to 1628 for the first half of the past year.

Italian imports of motor vehicles were very low during the first half of 1918, the value being about $75,000 for 92 touring cars and one truck. For the corresponding period of 1916 the figures were 178 trucks and nine touring cars. The following are the detailed returns, as issued by the Ministry of Finance:

AUTOMOBILE EXPORTS FROM ITALY

Six months ending June 30, 1918

	Trucks		Cars		Total	
Yr.	No.	Value	No.	Value	No.	Value
1916	2162	$4,791,056	569	$977,720	2731	$5,768,776
1917	3904	9,937,462	244	623,946	4148	10,561,408
1918	1628	3,898,080	728	1,836,160	2356	5,734,240

AUTOMOBILE IMPORTS INTO ITALY

Six months ending June 30, 1918

	Trucks		Cars		Total	
Yr.	No.	Value	No.	Value	No.	Value
1916	9	$14,840	178	$289,828	187	$304,668
1917	10	5,600	59	85,920	69	91,520
1918	1	4,000	92	56,112	93	60,112

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Hawthorne, Hamilton & DeLoss Merged

BRIDGEPORT, Feb. 7—The Hawthorne Mfg. Co. and the Hamilton & DeLoss Co. have been consolidated under the style Hawthorne Mfg. Co. The Hawthorne company was a maker of spot lamps and other automobile lights, and the Hamilton company's business was sheet metal products.

"Working Condition Service" Created

To Look After Health and Safety and Promulgate Labor Standards

WASHINGTON, Feb. 8—The Department of Labor has created a Working Conditions Service to investigate working conditions, determine standards and adopt regulations for the maintenance of such standards. The service will co-operate with State authorities. In order to properly function the service has been divided into three groups—health, safety and relations between the groups necessary to production. These will be known as the:

Division of Industrial Hygiene and Medicine.
Division of Labor Administration.
Division of Safety Engineering.

The Division of Industrial Hygiene and Medicine program proposes:

To make studies of working conditions in their relation to health to determine hazardous processes and methods;

To formulate sanitary codes and regulations to meet health hazards in the various industries;

To formulate standards of medical practice in industries, to co-operate in the betterment of medical service in industries and industrial centers;

To determine standards of physiological requirements of various occupations;

To determine methods for proper placement of workers;

To secure statistical data of industrial morbidity;

To promote facilities for the education and training of physicians and sanitarians for industries;

To assist industries in obtaining physicians and other technicians for industrial service;

To disseminate information concerning measures necessary to safeguard workers against industrial health hazards, and to secure co-operation of all elements, governmental and private, in furtherance of the industrial health program.

The Division of Labor Administration includes in its program:

Studies of employment systems and labor management policies, such as methods of hiring, selecting, inducting, and assigning employees to their duties, in order to determine causes of labor turnover and to avoid unnecessary rotation of labor.

Assisting industrial managers in studying their individual employment problems and advising them as to the best methods of hiring and selecting employees, reducing absenteeism and irregular employment, handling grievances, eliminating friction, and stimulating morale among the employees.

Establishing a national information center on employment and labor administration policies for the use of industrial managers, educational institutions and others, and distributing information.

Formulating standard policies of labor administration, and with the aid of a committee representing all interests affected, promulgating these standard policies to the country and urging their adoption by the industrial managers.

Acting as counselor or consultant on employment methods and policies, and assisting industries to put into operation the standard practices that are recommended.

Promoting facilities for training of labor administrators and assisting industries in obtaining such trained men for their plants.

The Division of Safety Engineering will include:

A study of the hazards of different industries and the determination of safety standards and codes to overcome such;

The encouragement of experiments on safety appliances and practices and the exchange of ideas concerning the same among industries specially interested;

In establishments where exceptional hazards are an integral part of industry, such as mines and explosive plants, the encouragement of co-ordinated plans by safety and medical supervisors to care for the victims in emergencies.

The standardization of record cards, survey forms, filing systems, charts and analytical procedure and presentation to enable safety engineers to have uniform systems for the collection and interpretation of data on plant hazards and injuries; the systematic elimination of the more serious hazards; the protection afforded the workers and like facts which justify the retention of safety work in plant management.

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Army Bill Abolishes M. T. C.

(*Continued from page* 388)

about this arrangement, probably by suggestion to the committee.

It is known that none of the army officers connected with the Motor Transport Corps testified with regard to the functions or importance of that corps to the committee. Amazement at the provisions of the bill is displayed, and particularly so because of the proof that motor transport must be pooled in this country from the experiences of France and Great Britain. The bill as it now stands, allowing each corps to operate and maintain its own trucks and other vehicles means a complete cessation of the standardization plan and a renewal of the original system whereby hundreds of types of trucks were operated and necessitated the maintenance of great stores of parts for maintenance and repair.

One of the first lessons that came out of the war was that idle trucks were a frequent result of the operation of trucks under different corps. There was no correlation of work. One corps cannot use the trucks of another corps.

An effort will be made, it is understood here, to present this matter properly before Congress and urge an amendment which will make an appropriation for the Motor Transport Corps and take the purchase, operation and maintenance of trucks from the other divisions, or pooling under the motor division. That either this step or the pooling of all the motor vehicles under the Quartermaster Department in one division is vitally important to the army, is the statement made by many army officers.

The army bill provides $4,000,000 for the Signal Corps, $10 000,000 for military air service, $449,000,000 for the Quartermaster Department and $3,000,000 for the Ordnance Department, and specifically states that these funds, in addition to the purchase of other supplies for each of these departments, are also for the "purchase, hire, operation, maintenance and repair of motor propelleld vehicles" by each of these respecttive departments.

Five hundred thousand dollars is also provided for the Ordnance Department for the purchase, manufacture and maintenance of armored motor cars. The sums appropriated are to remain available until December 31, 1920.

The legislative section of the bill provides for the repeal of the Overman act, an "act to authorize the President to co-ordinate and consolidate executive bureaus, agencies and offices in the interest of economy and more efficient concentration of the Government."

It authorizes the President to continue any such corps as he shall deem necessary, but since motor-vehicle appropriations have been made directly to each specific army corps, completely ignoring the Motor Transport Corps, that division could be continued only as a body without functions.

Furthermore, the statutes specifically state that the head of one department cannot disburse funds which have been appropriated in the name of another department, and even though the President might see fit to continue the Motor Transport Corps as such, it would be left without functions or funds, under the present provisions of the army bill.

One amendment which has been suggested and may be proposed for the army bill provides that all motor cars, trucks, trailers, motorcycles, and bicycles shall be under the Motor Transport Corps as regards engineering, purchase, operation and maintenance except armored cars and tractors and tanks, which will remaian under the Ordnance Department.

It also specifies that all appropriations for motor cars, trucks, trailers, motorcycles and bicycles should be placed at the disposal of one department, and further that the special bodies required by each army division such as the ambulance for the Medical Corps, and pigeon carriers for the Signal Corps are to be designed by the respective departments to fit the standard chassis as specified by the Motor Transport Corps.

American vs. German Exports

U. S. A. the Leader in Each of the Five Years Preceding the World War

	1909	1910	1911	1912	1913
Value of Germany's total exports of passenger cars	$4,066,000	$6,931,000	$10,099,000	$15,483,000	$16,897,000
Value of U. S. A.'s total exports of passenger cars	5,387,021	9,548,700	12,965,049	21,550,139	24,275,793
Value of German passenger cars exported to U. S. A.	193,580	368,219	297,153	259,313	261,168
Value of U. S. A. passenger cars exported to Germany	136,966	265,218	209,663	226,227	764,389

NEW YORK, Feb. 7—German commercial efficiency has been lauded to such an extent in the past that it may be a surprise to many to learn that during the five years preceding the war the United States not only exported cars to a greater value in each individual year, but sold to Germany passenger cars of a total value of $1,602,463 as against Germany's sales to the United States of cars valued at a total of $1,379,433 during the five years. A table giving Germany's and the U. S. A.'s passenger car exports by principal countries is published herewith.

A study of this table reveals the fact that certain countries, notably Russia, have been large importers of German cars. The geographical location of these countries is probably one reason for supporting the German industry, but another is that Germany has in the past given careful study to the requirements of each individual foreign customer and has not only furnished products which measure up to the local (and often arbitrary) standards, but has given the long credits customary. We, on the other hand, have furnished standard cars and, in the great majority of cases, have insisted that payment for them be made in accordance with the practice current in this country.

In 1913 Germany's total passenger car exports were valued at $16,897,000, as against the U. S. total of $24,275,793. Since 1913-14 Germany's export trade may be indicated by a zero sign, whereas in 1917 our exports of passenger cars alone were valued at $48,612,632, a high-water mark more than double our figure for 1913. In 1918 our car export figures receded a little, but were well maintained in view of the shortage of ocean transport, a gasoline famine which was practically world-wide and an almost universal lack of tires owing to restrictions affecting the supply of crude rubber.

Germany has ceased to be a competitor for the world's automotive markets for the time being, but England, France and Italy are making strong bids for trade with post-war models and prices which will be lower in all probability.

Value of Passenger Cars Exported by Germany and the U. S. A. for Five Years Before the War

Exported to	By	1909	1910	1911	1912	1913
Argentina	Germany	$76,000	$247,000	$589,000	$1,480,000	$1,228,000
	U. S. A.	81,614	174,677	423,193	860,350	1,181,735
Austria-Hungary	Germany	746,000	1,086,000	1,211,000	1,699,000	1,720,000
	U. S. A.	36,978	26,178	27,911	78,748	91,781
Australia	Germany	23,000	67,000	117,000	177,000	159,000
	U. S. A.	81,426	268,274	874,112	2,260,320	1,896,990
Belgium	Germany	132,000	474,000	293,000	818,000	769,000
	U. S. A.	46,340	147,375	241,269	140,585	85,679
Brazil	Germany	34,000	298,000	640,000	1,586,000	857,000
	U. S. A.	26,892	267,687	225,083	662,883	1,035,247
British South Africa	Germany	55,000	89,000	63,000	45,000	159,000
	U. S. A.	22,152	61,185	126,734	306,606	1,157,895
Bulgaria	Germany	16,000	5,000	8,000	100,000	75,000
	U. S. A.	.....	1,890	6,350	19,716	11,457
Cuba	Germany	16,000	5,000	18,000	15,000	139,000
	U. S. A.	140,160	187,392	208,960	234,569	242,686
Denmark	Germany	140,000	252,000	376,000	363,000	625,000
	U. S. A.	29,967	46,024	40,021	41,976	77,149
Dutch East Indies	Germany	55,000	126,000	217,000	293,000	219,000
	U. S. A.	40,836	21,768	34,252	70,055	198,378
Finland	Germany	17,000	61,000	225,000	256,000	306,000
	U. S. A.	.....	.....	12,049	26,203	53,568
France	Germany	431,000	651,000	672,000	836,000	869,000
	U. S. A.	643,692	771,869	473,122	469,721	615,486
Italy	Germany	175,000	131,000	221,000	419,000	665,000
	U. S. A.	240,516	333,193	188,405	193,037	280,961
Mexico	Germany	52,000	119,000	243,000	58,000	142,000
	U. S. A.	282,462	459,077	614,160	418,599	423,123
Netherlands	Germany	210,000	406,000	431,000	694,000	724,000
	U. S. A.	53,965	76,957	50,796	78,363	94,163
Norway	Germany	71,000	50,000	60,000	103,000	168,000
	U. S. A.	8,079	20,669	13,808	66,897	66,689
Portugal	Germany	25,000	57,000	74,000	131,000	215,000
	U. S. A.	3,041	11,429	23,966	14,752	58,931
Roumania	Germany	93,000	94,000	154,000	555,000	214,000
	U. S. A.	.....	.....	31,806	22,543	30,337
Russia	Germany	583,000	1,098,000	1,823,000	2,540,000	4,232,000
	U. S. A.	78,409	107,310	139,487	254,047	484,913
Siam	Germany	36,000	44,000	23,000	44,000	52,000
	U. S. A.	.....	6,407	6,540	8,933	35,934
Spain	Germany	61,000	61,000	90,000	175,000	347,000
	U. S. A.	9,061	18,330	54,599	116,202	127,621
Sweden	Germany	54,000	90,000	173,000	337,000	436,000
	U. S. A.	44,585	55,118	62,005	127,729	235,918
United Kingdom	Germany	523,000	857,000	1,316,000	1,737,000	1,215,000
	U. S. A.	1,680,154	2,415,593	2,273,222	4,454,430	2,907,427
Uruguay	Germany	.....	8,000	120,000	181,000	172,000
	U. S. A.	5,657	23,666	147,142	235,097	273,253

German Truck Train Organization

Run on Fuel Substitutes and Steel Rims—Gasoline Reserved for Air Force

By W. F. Bradley

PARIS, Jan. 20—Two types of automobile truck trains exist in the German army. These are known as Army columns and Division columns. An Army column, or truck train, consists of 18 trucks of 4 ton capacity, one of which is a traveling workshop. The effective tonnage is thus about 60. Attached to this train are two passenger cars, one or two motorcycles and a trailer kitchen. This organization is practically the same as that adopted by the French. The staff of an army truck train comprises a captain and a lieutenant, one sergeant-major, four or five non-commissioned officers and 51 men.

The Divisional truck trains comprise ten trucks of 4 ton capacity, one of which is a workshop, and this train has a practical tonnage capacity of 30 tons. There is also one passenger car, one motorcycle and one kitchen trailer. The staff of such a truck train consists of an officer, a sergeant-major, four to five non-commissioned officers and 30 men. The Divisional truck trains are made use of for all kinds of transportation required by the division.

Early in the war the German army made use of some special types of meat-carrying trucks. These, however, were abandoned later, and two or three ordinary trucks from the train were given this work.

The Army columns or trains were designed to supplement the Divisional trains, and were employed especially for carrying munitions from the rear to the dumps or batteries. Repairs were handled in the German army by repairshops, usually one for each army.

The real rubber shortage in the German army made itself felt in 1916. Up to this time all cars and trucks had been run on rubber tires. Suddenly rubber disappeared from the trucks and steel rims or wood blocks, sometimes surrounded by a steel rim, were made use of everywhere. At the same time every automobile unit was give only one truck equipped with rubber tires. This vehicle was used for carrying delicate objects and also as a break-down truck.

With either wood or steel tires it was impossible to obtain sufficient adherence to tow other vehicles. Pneumatic tires were only used on light cars and ambulances operating in the advance zone. All vehicles on the lines of communication or in the zone of the rear were equipped with various types of steel tires. Many of these had coil springs interposed between the outer rim and the wheel.

It is interesting to note that the German army employed "Continental" and "Oberspree" tires almost exclusively. A

certain number of Michelin tires were in use until 1917. It is not known whether these were requisitioned in the invaded districts of France or whether they were made in moulds stolen in France. In any case, the fact that these tires were available until 1917 indicates that rigid economy was effected in their use.

For a long time before the end of the war the automobile service of the German army was altogether deprived of gasoline, this fuel being reserved for the air service. During practically the whole of the war trucks and passenger cars were run on benzol or on a mixture of benzol and alcohol. During one particular period, in 1916, the fuel employed consisted of 40 per cent benzol and 60 per cent alcohol. As neither engines nor carbureters had been built for this fuel results were very unsatisfactory, and it was not long before the percentage of alcohol was reduced.

It is stated that the German army was never totally out of fuel, but at all times the service was restricted because of shortage. As in the case of the French army since 1917, all German automobile units had a ration supply of fuel. When this supply was exhausted the cars remained in the garage, in some cases for two or three months.

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Foreign Trade Opportunities

WASHINGTON, Feb. 8—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has inquiries for the agencies of automobiles and tractors. Full information regarding each of the following can be secured by addressing the Bureau of Foreign and Domestic Commerce and referring to the foreign trade opportunity number.

A man in Norway desires to purchase an agency for the sale of automobiles and accessories. Foreign Trade Opportunity No. 28120.

An agency is desired by a man in France for passenger cars. Correspondence should be in French. No. 28121.

An agency for passenger cars, oils and greases is desired by a man in France. Correspondence should be in French. No. 28125.

Requests for an agency for passenger cars, bicycles and tool supplies has been received from a man in France. Correspondence may be in English. No. 28127.

A company in Sweden desires an automobile supplies and accessories agency. Correspondence may be in English. No. 28130.

A firm in Spain desires to secure the sole agency and to act as purchaser of farm tractors for the Balearic Islands. Quotation should be made f.o.b. New York, cash against documents. Correspondence may be in English. No. 28126.

A business man in Spain desires an agency for automobiles, tractors, petroleum and gasoline. Correspondence should be in Spanish. References have been filed. No. 28134.

A business man in France desires an agency for automobiles and tractors. Correspondence in English. No. 28155.

A business man in France desires an agency for passenger cars, tractors, trucks, petroleum, gasoline and heavy oils for Morocco. Correspondence should be in English. References have been filed. No. 28141.

A man in Algeria desires an agency for motor cars. References have been filed. Payment against documents or confirmed credit. No. 28150.

A business man in France desires an agency for passenger cars and tractors. Correspondence in English. No references have been filed. No. 28155.

A commercial agent in France desires a farm tractor agency. Correspondence in French. No. 28137.

An agency is desired in France for farm tractors. Terms, cash on delivery to France. Correspondence in French or Spanish. No. 28143.

Australia Expects Big Developments in Automotive Business

Activities Have Been Curtailed by After-War Conditions and Heavy Taxation, but Revival Is Imminent—Expected Reaction in Favor of European Cars—No Shortage of American Products

SYDNEY, N. S. W., Jan. 3—There are several circumstances which in combination have had the effect of slowing down the automotive business in Australian cities for some time past. In the first place, the country has been suffering from a severe drought which has practically ruined the wheat crop. Fires have caused a lot of damage to farms and cattle in Northern Queensland, and the general effect has been detrimental to the sale of automotive products.

A second reason for business slackness lies in the fact that last season's wheat has not yet been shipped, and the farms do not expect to get a remunerative price for it. The Government has paid about 84 cents a bushel for it so far, but there is a shortage of buyers. A third reason is the passing of a compulsory act by the Government in connection with the seventh war loan.

A bill known as the wartime profit tax has apparently hit the automotive dealers pretty hard, as it is retroactive for the three years of war which had elapsed before it became law, and thus a trader is taxed to the extent of 50 per cent of his profits over and above 10 per cent of his capital. As this affects profits made up to three years before, profits which have already been distributed in dividends or diverted to the extension of business, the tax is proving onerous to many. In fact, the effort to meet it has tied up operating capital to a considerable extent.

Armistice Affects Prices

Prices of commodities generally started to drop on the signing of the armistice, and the country has not as yet succeeded in reconstructing itself on a pre-war commercial basis.

There are fairly good stocks of the various popular types of American cars throughout Australia—Buick, Chevrolet, Dodge, Hupmobile, Overland, etc., but apparently stocks of other makes are somewhat depleted. The used car market is very flat, owing to the popular belief that prices will drop. It is not anticipated that this state of things will be anything but temporary.

There has been a sufficient supply of tires, although at times the selection of makes has been limited. On the whole, the local rubber factories are able to take care of the demand, and the situation has been improved by importers having cars shipped complete with tires instead of minus tires as before.

There is an ample supply of spare parts for both cars and trucks in the various cities throughout Australia. Occasionally there have been difficulties in shipping these from the United States factories, but in such cases parts have been made locally.

Very successful demonstrations of farm tractors have been held from time to time, and it is anticipated that this branch of the business will develop rapidly as soon as the initial difficulties of arranging distribution are overcome. Unit power and lighting plants are fast finding their way into the country, and the business is generally handled by the electrical supply firms, of which there are many throughout the Commonwealth.

Gasoline Plentiful but High

Gasoline is plentiful, but expensive. The price averages 75 cents an American gallon in the cities. There is also an ample supply of lubricating oil.

One of the reasons why there has been no increase in the price of cars brought about by shortage of supply is that a large percentage of the dealers here find it necessary to dispose of their stocks as quickly as possible in order to get their cash in again and thus keep their total operating capital at the lowest practicable amount. This condition of temporarily tied-up finance is mainly the result of conditions outside the automotive trade, the strain of war taxation and abnormal trading conditions generally.

There is every indication that there will be a big demand for European cars just as soon as any are available. It is not yet known here what European manufacturers may have to offer in the shape of post-war models, but Australians are naturally a British people and therefore are favorably disposed to any British product. Nevertheless it is early to predict what the future may hold in the automobile line, and it is quite obvious that the British or other European manufacturer will have to go a long way to beat the American car builder or to dispossess him of the trade he now holds. There seems to be a reaction in favor of first-class magneto ignition as compared with ignition of battery type.

In conclusion, there is no doubt whatever but that the European car builders are planning extensive and energetically conducted selling campaigns on their after-war products throughout Australia, and it is natural to expect that under the circumstances they will meet with a fair measure of success. Therefore the American car builder must look to his laurels and intensify his sales methods to retain his trade here.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. ..... .02 -.03
Phosphoric (85%).. .35 -.39
Sulphuric (60%), lb. .008

Aluminum:
Ingot, lb..... .30 -.33
Sheets (18 gage or more), lb. ..... .42
Antimony, lb..... .07¼-.07½

Burlap:
8 oz., yd..... .10½
10½ oz., yd..... .16½

Copper:
Elec., lb. ..... .18 -.18½
Lake, lb. ..... .21

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.50
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.15
Peelers, combed, sq. yd. 1.10
Peelers carded, sq. yd. 1.00
Fibre (⅛ in. sheet base), lb. ..... .50

Graphite:
Ceylon, lb. ..... .09 -.22
Madagascar, lb. .. .10 -.15
Mexico, lb. ..... .03¾

Lead, lb. ..... .4474-.0525

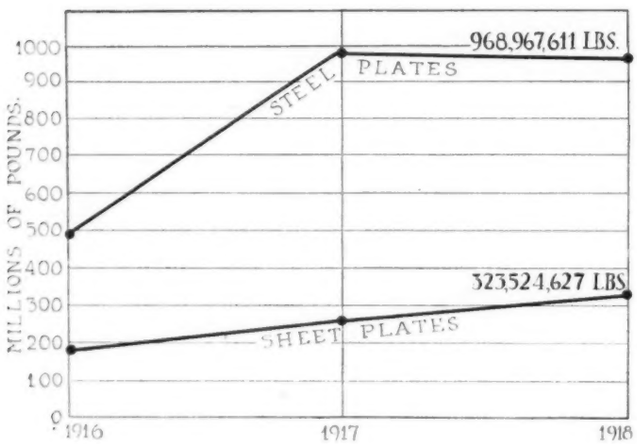
Leather:
Hides, lb. ..... .18 -.35¼

Nickel, lb. ..... .40

Oil:
Gasoline:
Auto. gal. 24½
68 to 70 gal..... .30½
Lard:
Prime City, gal..1.90-2.00
Ex. No. 1, gal...1.10
Linseed, gal. 1.45-1.48
Petroleum (crude):
Kansas, bbl. 2.25
Pennsylv'a, bbl..4.00
Manhaden (dark), gal. 1.05-1.06

Rubber:
Ceylon:
First latex pale crepe, lb. ..... .57½-.58
Brown, crepe, thin, clear, lb. ..... .52
Smoked, ribbed sheets, lb. .... .56½-.57
Para:
Up River, fine, lb. .59 -.59½
Up River, coarse, lb. ..... .34 -.35

Island, fine, lb..... .49
Shellac (orange), lb. .64
Spelter ..... .07½-.07¾
Steel:
Angle beams and channels, lb. .... .03
Automobile sheet (see sp. table.)
Cold rolled, lb.... .0625
Hot rolled, lb..... .039
Tin ..... .71 -.72
Tungsten, lb.....1.50-.2.10
Waste (cotton), lb.. .12¾-.17



Exports of steel plates and sheets for 10 *months of* 1916-17-18. *In* 1918 *Canada and Japan were our best customers. The United Kingdom and France took a very small proportion*

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock.....	$5.95	$5.85
Automobile body stock, deep stamping.	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock.....	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping.....	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.
Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.
Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Feb. 8

	Bid	Asked	Net Ch'ge
Auto Body Company.....	6½	8½	..
Briscoe Motor Car, com.....	10	..	— ½
Briscoe Motor Car, pfd.....	35	50	—5
Chandler Motor Car.....112⅛	114⅛		+4⅝
Chevrolet Motor Car.....154	156		+5
Cole Motor Car.....	90	105	..
Continental Motors, com....	7½	8	..
Continental Motors, pfd....	95	99	+1
Edmunds & Jones, com.....	15	20	..
Edmunds & Jones, pfd.....	75	90	..
Electric Storage Bat.....	50	55	..
Federal Motor Truck.....	30	34	—1
Fisher Body Co., com.....	42½	43	+2½
Fisher Body Co., pfd.....	90	92	..
Ford Motor of Canada.....265		275	+10
General Motors, com.....130½	131½		+6⅛
General Motors, pfd.....	83¾	85⅞	+ ⅞
Hupp Motor Car, com.....	6¼	7	+ ⅜
Hupp Motor Car, pfd.....	90	..	+ ½
Kelsey Wheel Co., com.....	28	36	—2
Kelsey Wheel Co., pfd.....	88	95	..
Manhattan Electric S., com.	..	48	..
Maxwell Motor, com.....	30⅜	31⅜	+ ⅛
Maxwell Motor, 1st pfd.....	53½	54½	+1
Maxwell Motor, 2nd pfd....	21½	22½	..
McCord Mfg., com.....	32	35	..
McCord Mfg., pfd.....	93	96	..
Mitchell Motor Co.....	24	30	..
Motor Products Corp.....	..	40	..
Nash Motors Co., com.....170		200	..
Nash Motors Co., pfd.....	93	97	..
National Motor Co.....	6	10	..
Packard Motor Car, com....116		122	..
Packard Motor Car, pfd....	99	103	..
Paige-Detroit Motor, com...	24½	25½	+1
Paige-Detroit Motor, pfd...	8¾	9¾	..
Peerless Motor Truck.....	18	21	..
Pierce-Arrow Mot. Car, com.	39	40	—2
Pierce-Arrow Mot. Car, pfd.102		..	+1
Premier Motor Corp., com..	5	..	..
Premier Motor Corp., pfd...	..	75	..
Prudden Wheel Company...	15	17	+1
Reo Motor Car Co.....	21½	22½	..
*Republic M. Truck, com...	35½	37½	—2
Republic M. Truck, pfd.....	87	90	..
Saxon Motor Car, com.....	7½	9½	+ ½
Scripps-Booth Corp.....	21	25	..
*Stewart Warner Spd. Corp.	83¾	85¾	+ ½
Stromberg Carburetor Co...	40	43	+1
Studebaker Corp., com.....	50½	51½	+ ¼
Studebaker Corp., pfd.....	92	95	..
Stutz Motor Car Co.....	42¼	43¼	—5¾
United Motors Corp.....	38	40	+2⅝
White Motor Co.....	47	48	+ ⅝
*Willys-Overland, com.....	24¼	25¼	..
Willys-Overland, pfd.....	88	88½	+ ¼

	Bid	Asked	Net Ch'ge
RUBBER STOCKS			
Ajax Rubber Co.....	70	70¾	..
Firestone T. & R., com.....140		145	..
Firestone T. & R., pfd.....	95½	100	..
Fisk Rubber Co., com.....	87	89	—1
Fisk Rubber, 1st pfd.....	97	100	..
Fisk Rubber, 2nd pfd.....	85	90	..
Fisk Rubber, 1st pfd. conv..100		105	..
Goodrich, B. F., com.....	61	61¼	..
Goodrich, B. F., pfd.....102½		103	..
Goodyear T. & R., com.....240		250	—7
Goodyear T. & R., 1st pfd..103½		105	+ ½
*Goodyear T. & R., 2nd pfd.103½		105	— ½
Kelly Springfield, com.....	77	78	..
Kelly Springfield, 1st pfd....	91	98	..
Lee Tire & Rubber Co.....	23	23½	..
Marathon Tire & Rubber... ..		55	..
Miller Rubber Co., com.....160		165	..
Miller Rubber oC., pfd.....	96	98	..
Rubber Products Co.....114		118	..
Portage Rubber Co., com...155		160	..
Swinehart T. & R. Co.....	50	60	..
U. S. Rubber Co., com.....	75½	76	..
*U. S. Rubber Co., pfd.....109¼		110	..

*Ex Dividend.

R. T. Hodgkins, general sales manager of the Cleveland Tractor Co., was elected a director of that company at a recent meeting of the stockholders and at the directors' meeting following he was chosen vice-president.

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Horace N. Trumbull, who was advertising manager for the S K F Ball Bearing Co., Hartford, before he entered the service, has been discharged and has become advertising manager of the Wellman-Seaver-Morgan Co., Cleveland.

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W. M. Jones has been appointed eastern sales representative of the Torbensen Axle Co., Cleveland.

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E. D. Rogers has joined the staff of the Anderson Motor Co., Rock Hill, S. C., as southwestern district sales manager, with headquarters at Dallas.

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A. C. Olfs, formerly eastern representative of the Titanium Bronze Co., has been appointed Michigan representative for the Stewart Mfg. Corp., Chicago, with headquarters in Detroit.

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L. B. Cravath has been elected vice-president of the Hessian Tiller & Tractor Corp., Buffalo. He joined the organization as sales manager. He was later made general manager and has recently been chosen a director.

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Robert E. Page, for four years assistant foreign sales manager for Dodge Brothers, has joined the staff of the Commerce Motor Car Co. He will look after the Canadian Commerce Truck business.

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J. J. Tobias is in charge of the new Detroit branch of the Moto Meter Co., Inc., 2019 Dime Bank Building.

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C. H. Williams, formerly manager of the Chicago branch of the Goodyear Tire & Rubber Co., Akron, has been appointed manager of the far eastern division, which covers the Philippines, China, Japan, Java, Siam, India and Eastern Russia.

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C. L. Diers, formerly in charge of the Indianapolis branch of the Goodrich Tire & Rubber Co., Akron, is now in charge of the European division, covering Europe, Asiatic Russia and the northern coast of Africa.

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W. A. Westlake has been appointed eastern sales manager of the truck tire department of the McGraw Tire & Rubber Co., New York.

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W. R. Vogeler, for the past six years export manager of the King Motor Car Co., New York, has been appointed general manager to take the place of E. A. Scheu, who has been made general sales manager.

Men of the Industry

Changes in Personnel and Position

Bartsch Takes Up Sales and Advertising Reins for Bosch

NEW YORK, Feb. 10—Alfred H. Bartsch has returned to the American Bosch Magneto Co. after an absence of a little more than a year. Effective immediately he takes up the duties of advertising manager, which he surrendered just before this country entered the war, and, in addition, has been appointed the company's general sales manager. Prior to the time he left the old Bosch company, which has since been reorganized, Bartsch was for more than seven years its advertising manager. He left that position to become affiliated with the McLain, Hadden, Simpers Co. advertising agency, and for about a year has made his headquarters in Philadelphia. Henceforth his headquarters will be in New York.

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C. J. P. Lucas, Chicago, for the past eight years with the *Automobile Trade Journal,* has resigned, and about April 1 will leave for South America to make a survey of the South American market with a view to establishing a house in Buenos Ayres for carrying an American car, truck and tractor and lines of supplies for Argentina, Paraguay, Uruguay, Brazil and Chile.

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Judson M. Sells, until recently general manager of the Northern Steamship Co., has joined the sales force of the Commerce Motor Car Co. in the Buffalo territory.

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Harry Moler, Grand Rapids, has quit the theatrical business to sell Willys-Knight and Overland cars.

—

Honor Blocker has been appointed advertising manager of the Republic Rubber Corp., Youngstown.

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F. S. Wright, who has been for many years sales manager of the New York branch of the Valvoline Oil Co., has resigned his position to become connected with the James B. Berry's Sons Co., Inc., Oil City, Pa., as sales manager of this company's New York branch.

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F. H. McFarlin has joined the sales department of the Erie Specialty Co., Erie.

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Frank Mossberg Joins Rice Leaders

ATTLEBORO, MASS., Feb. 10—The Frank Mossberg Co. has become a member of the Rice Leaders of the World Association.

A. R. Redburn has been appointed sales manager of the truck department of Walden W. Shaw Livery Co., Chicago.

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Gustave Huette, Sheboygan, Wis., founder of the Falls Motors Corp., Sheboygan Falls, and for many years president of the company, has disposed of his final interest and retired from all connection with the concern.

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R. G. Hayssen, secretary and treasurer of the Sterling Motor Truck Co., Milwaukee, was elevated to the presidency at the annual meeting of the stockholders. He succeeds Victor L. Brown, who has retired from active business. E. M. Sternberg was elected vice-president and Frank Luick secretary and treasurer. The company will devote most of its energy until March 1 to the completion of its government contracts and will then shift to peace business.

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E. H. Ruck has been appointed chief engineer of the Automotive Corp., Fort Wayne, and will have charge of all engineering and production. He was formerly with the White Co., and until a few weeks ago was chief engineer of the Cleveland Tractor Co., Cleveland.

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George K. O'Donnell has been elected vice-president in charge of the sales of the Coe-Stapley Mfg. Corp., with headquarters in New York City. The New York offices of the company have recently been moved from 135 Broadway to 136 Liberty Street.

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John Walter Hertzler has been elected secretary and treasurer of the Pressed & Welded Steel Products Co., Long Island City. He was formerly assistant manager of the Bearings Co. of America, Lancaster, Pa.

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J. H. Cooper, formerly vice-president of the Endurance Tire & Rubber Co., has joined the sales force of the Walker Mfg. Co., Racine, as eastern sales manager.

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W. B. Stout, formerly of the Packard Motor Car Co., has been appointed sales and advertising manager of the United Aircraft Engineering Corp., New York.

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J. J. Buzzell has been appointed advertising manager of the Hyatt Roller Bearing Co., Detroit, to succeed W. E. Biggers, who recently resigned.

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J. W. Lever is now district manager of the Denby Motor Truck Co., Detroit. His territory is Oklahoma and Texas.

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Capt. Charles Smith, Engineers, U. S. A., who is connected with the Commerce Motor Car Co., has returned from overseas.

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A. E. Creeger, identified since its organization with the Nash Motors Co., Kenosha, as special traveling representative, has resigned to become associated with the Ohio Nash Co., in charge of truck sales.

J. I. Case Passes Resolution to Re-employ Returning Men

RACINE, Feb. 7—At a meeting of the Board of Directors of the J. I. Case Plow Works, the following resolution was unanimously adopted:

"Resolved, That all employees of the J. I. Case Plow Works, who left their positions for military service, at home or abroad, will be given re-employment at a compensation at least equal to what they were receiving when they left their positions, provided that such employee desires to return and makes application and reports for duty within thirty days after honorable discharge."

The same policy will be followed by the Wallis Tractor Co.

Briscoe After Foreign Business

JACKSON, Feb. 7—Although running at 50 per cent capacity, the Briscoe Motor Corp. is now producing thirty cars daily. The company plans increasing production constantly until the daily average is between sixty and seventy machines. The 1919 schedule calls for 15,000 cars. This company has established an export office at New York and is preparing to engage extensively in foreign trade.

New G. M. C. Plant at Flint

FLINT, Feb. 8—The General Motors Corp. is to establish a new frame plant here. It will be on a spur line of the Michigan Central Railroad. Such a plant has been contemplated for some time.

Auto Body Co. Speeding Production

LANSING, Feb. 8—The Auto Body Co. has completed a definite schedule of production, which will keep the plant busy for three months. The company is now employing 400 men. Six weeks ago less than 100 men were employed.

Packard Still Filling Government Orders

DETROIT, Feb. 7—No new Packard passenger cars will be ready for distributers before early summer. This company, which was working 100 per cent on Liberty engines and Packard army trucks, is obliged to reorganize completely its plant before passenger car production can be resumed. War contracts are being wound up. The last of the Liberty engines are about to be run through, but there is still a large number of trucks to be made.

No New Columbia Models

DETROIT, Feb. 7—There will be no change in the car models of the Columbia Motors Co. Three models will be produced: The touring at $1,600; the five-passenger Bevel Edge Sport, $1,745, and the sedan, $2,445. The sport model is a new one, having been brought out during the past summer. There will be no cut in prices. The Columbia Co. expects to be in full production by Feb. 15. Its contracts for government trucks, trailers and truck parts are about complete. The company is producing 8 passenger cars daily.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

"Red Star" Bodies in New Building

PHILADELPHIA, Feb. 7—The Lowry Top and Body Co., manufacturer of automobile tops and bodies, specialist for long distance hauling concerns, using bodies from two to six tons and upwards, has moved from 33d and Walnut streets to its new factory at Gaul and Adams streets, in the Kensington district. The company's new quarters allow 70,000 sq. ft. for manufacturing purposes. There are painting, trimming and mill departments on the first floor, and the body-building department proper on the second.

The company is about to produce its newly patented "Red Star" bodies. The patent covers a non-leakable roof, the top construction known as "outside structural member," the general underconstruction and the tail-gate. The patent is especially for the large, covered type of car for intercity hauling. The outside structural member used is of the "waffle-iron" bracing type, of 2-in. oak and is calculated to withstand high pressure both from within and without the top. The raised panel frames prevent accidents to goods within the car, no matter how hard a blow the top may receive. A complete line of these bodies will be carried.

Goodrich Sales Total $123,400,000

AKRON, Feb. 7—The annual report of the B. F. Goodrich Co., made public Saturday, shows net sales amounting to $123,400,000 and net profits $15,500,000, not deducting federal income or excess taxes but after deducting for maintenance, depreciation, bad and doubtful debts. For the year ended Dec. 31, 1917, the net sales of the company amounted to $87,155,072 and the net profits $10,544,677. The directors have authorized a 3½ per cent dividend on preferred stock, half payable April 1 and the rest July 1. They also declared a 1 per cent quarterly dividend on common, payable May 15.

Pierce Governor Erects Addition

ANDERSON, Feb. 7—The Pierce Governor Co. has just completed a two-story brick annex to its factory, giving it an additional 5,000 sq. ft. of floor space. The new building will be used for storing raw material and finished parts. The tool making and pattern making departments will also be moved into it.

Atterbury Doubles Capital

BUFFALO, Feb. 7—The Atterbury Motor Car Co. has increased its capital from $250,000 to $500,000.

Nelson Motor Truck Co. Incorporates

SAGINAW, Feb. 7—The Nelson Motor Truck Co., maker of the Jumbo truck, this week changed from a co-partnership to an incorporation, with a capitalization of $500,000. The officers of the company are: President and general manager, H. B. Nelson; vice-president, J. J. Nelson; secretary and treasurer, C. J. Nelson. The company is making a truck a day, but anticipates producing 1200 machines this year. A new factory addition is under construction and plans for building a complete new plant are being considered for next year.

Telecator in New York Office

NEW YORK, Feb. 7—Herbert H. Scott, president of the Scott Corp., Chicago, manufacturer of the Telecator, an instrument for locating faults in car and truck engines, has opened an office in Aeolian Hall, New York, as a base for Eastern business. This office will be in charge of Guy Rickenbaugh. The Telecator is the invention of Mr. Scott, and is made in two models, one for attachment to the dash where it also acts as a lock for the car, and the other a portable instrument for use in garages. The total output of the company so far has been supplied to the Government.

Monroe Plant to House Moline Engines

PONTIAC, Feb. 8—The plant and property of the Monroe Motor Co., which was sold recently for $75,000 to the Wilson Foundry & Machine Co., will be used for the production and assembly of engines for the Moline Tractor Co. All Moline engine parts will be made either in the present Wilson plant or in the new plant. About 500 men will be employed. First deliveries will be made in April.

General Motors Buys in Canada

DETROIT, Feb. 10—The General Motors Corp. has purchased a 37-acre factory site in Windsor, Ont. General Motors officials will make no statement regarding the proposed Canadian activities of their organization.

Defiance Plant Quits War Work

DEFIANCE, Feb. 7—The Defiance Machine Works, which has been on a 100 per cent war basis, has voluntarily discontinued its contract for the manufacture of big guns for the Government. It is intended to save the Government further expense in operating this plant and enable the management to readjust the factory for handling peace-time business.

Overland Speeding Up Production

TOLEDO, Feb. 10—The Willys-Overland Co. has increased its daily production for February to 400 cars. During January the plant's daily average was 320 finished jobs. Odds and ends of war work are being cleaned up and reconstruction is about complete. The company is now operating at two-thirds capacity. It will be July at least before full production of 600 cars daily will be obtained.

Canadian Chalmers to Make 2000 Cars

WINDSOR, ONT., Feb. 8—The Chalmers Motor Co. of Canada, Ltd., will produce 2000 cars this year. The company, which is turning out 10 cars daily, contemplates no price reduction, and is guaranteeing its dealers against such a move.

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Canadian Maxwell Plans 6000 This Year

WINDSOR, ONT., Feb. 8—Approximately 6000 cars will be made by the Maxwell Motor Co. of Canada, Ltd., during 1919. The 1919 Canadian Maxwell has a different style top than the 1918 model, demountable rims instead of wheels, a Johnson carbureter with vacuum feed and a gasoline tank on the rear. The company anticipates no price reduction and is protecting its dealers. It is producing 25 cars daily, but will increase the output in June.

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Annual Meeting of Detroit Steel Products Co.

DETROIT, Feb. 10—The Detroit Steel Products Co., at its annual meeting, elected the following officers: President, John G. Rumney; vice-president and general manager, Victor F. Dewey; secretary, H. F. Wardwell; treasurer, E. R. Ailes; assistant general manager, Mason P. Rumney; production manager, A. L. Baldwin.

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B. R. & L. Co. Changes Officers

CLEVELAND, Feb. 10—The Baker R. & L. Co., makers of Rauch & Lang electrics, Owen Magnetic gasoline cars and B. R. & L. Electric industrial trucks and tractors, has made several changes among its administrative staff. C. L. F. Wieber has resigned as president and is now acting as chairman of the board. Fred R. White, previously vice-president and in charge of production, is now president. E. J. Bartlett, previously manager of the commercial department, is now vice-president and general manager. R. M. Owen and D. C. Durland remain as vice-presidents of the company. Robert C. Norton remains as treasurer, but for some time has been in France as a major of artillery. His active duties are being performed by W. P. Southward, assistant treasurer. F. W. Treadway remains secretary and counsel of the company.

The company, which is now running about ten cars daily, expects to increase its production of industrial trucks and custom bodies and to continue its other products on the present scale. Manufacture of 4000 cars is contemplated in 1919. The largest production increase will be in the body department and in industrial trucks.

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20,000 Sq. Ft. for Ahlberg Bearings

CHICAGO, Feb. 10—Owing to the government ban on building operations during the war, the Ahlberg Bearing Co. had to wait until this time to commence work on its new plant at 29th Street and Calumet Avenue. Operations have already been started and it is expected that the new factory will be ready for occupancy the latter part of February. The new building will be two stories, of steel and reinforced concrete, with a floor space of about 20,000 sq. ft. The lighting has been so designed that every part of the building will be available for the handling of the remaking process. Provisions have been made for a hardening plant also. The first floor will contain the salesroom, stock room and shop. The executive and general offices will occupy the second floor, and a garage will be erected in the rear.

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General Motors to Build for Scripps-Booth

DETROIT, Feb. 10—The General Motors Corp., which recently gained control of the Scripps-Booth Corp., will establish that company in a new $1,500,000 factory building as soon as a suitable site can be obtained. The proposed plant will have a capacity of 25,000 cars annually. In the present establishment the Scripps-Booth organization is cramped for room. Unlike most other automobile concerns, this company was not seriously affected by the sudden ending of the war inasmuch as it was not engaged very extensively in Government work.

The company is making twenty cars daily, but in February it expects to boost production to thirty cars. While 5500 machines were built last year, the 1919 schedule calls for the manufacture of 10,000. The 1919 Scripps-Booth models are the same as last year, with the exception of several small changes in detail and in color.

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Gier Steel Profit $427,903

LANSING, Mich., Feb. 10—The newly elected Board of Directors of the Gier Pressed Steel Co. held its election following the annual meeting of the company, Wednesday, Jan. 22, and named B. S. Gier, president and general manager; W. H. Newbrough, vice-president, and D. F. Edwards, secretary and treasurer. W. K. Prudden was elected chairman of the board. The new board is composed of the officers and H. F. Harper, Edward Ver Linden and Arthur D. Baker. The annual financial statement shows an operating profit of $427,903.03, or 55 per cent of the outstanding stock. This is double that of 1917. The estimated Federal tax on this year's operations is $290,000, or 68 per cent of the total profit. The surplus on Dec. 31, 1917, plus the net income for operations makes a total of $638,200.82. Out of this comes the estimated Federal tax, leaving $347,200.82. From this is deducted $156,250, the stock dividend declared Jan. 15, 1918, and the cash dividend of 5 per cent or $39,062.50 of Dec. 13, 1918, leaving an extended total of $151,888.32.

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Dividends Declared

Grant Motor Car Corp., Cleveland, 1 per cent, common, payable March 1 to stockholders of record Feb. 18; 1¾ per cent, preferred, payable Feb. 1 to stockholders of record Jan. 20.

Reorganize United Brass & Aluminum

PORT HURON, Feb. 10—The United Brass & Aluminum Mfg. Co. has been reorganized with the following officers: President, Jacob Goldman; vice-president, H. S. Grant; secretary and treasurer, Shirley Stewart, and Albert Ryan general manager. This concern was formerly the William O. Lee Co. The plant has been extended and is now making brass bushing for the Packard, Northway Motors Co. and a number of other automotive concerns.

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Boring Tractor's New Plant

ROCKFORD, Feb. 10—The Boring Tractor Corp. has purchased six acres of land and will erect a new plant on this tract. The tracks of three railroads are located close to the new site, giving excellent transportation facilities. It is hoped to have the first unit of the new series of buildings ready by May 1. Reinforced concrete will be utilized in the construction.

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Melling Forge Co. Elects New Officers

LANSING, Feb. 10—The Melling Forge Co. at its annual meeting elected the following officers: President, J. B. Simon; vice-president and general manager, George Melling; secretary and treasurer, J. B. Whitney. The company was organized in March, 1917. During the year machinery and equipment have been doubled and the working force increased 150 per cent. Ninety-five per cent of the output of this plant has been Government work, but contracts with the Olds Motor Works and the American Car and Foundry Co. have already been placed for 1919.

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Grant Motors Gains $450,000 in Year

CLEVELAND, Feb. 10—The net earnings of the Grant Motor Car Corp. for the year ended Dec. 31 were in excess of $450,000, after paying the preferred dividends, which left a balance of more than 20 per cent on common stock.

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Chevrolet Will Expand

DETROIT, Feb. 10—The Chevrolet Motor Co. plans to expand its factory at Toledo to a $4,000,000 or $5,000,000 plant within two years, according to T. W. Warner of the Toledo-Chevrolet Motor Co. Additional property of approximately five acres has been purchased for new buildings. The plant has been employing 1200 men, and it is expected that from 3000 to 4000 will be employed when the new additions are complete.

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U. S. Pressed Steel Co. Enlarges Plant

YPSILANTI, Feb. 10—The U. S. Pressed Steel Co. has greatly enlarged its plant here. It has installed the conveyer system, and is now making steel products for tractor concerns. Among its contracts are seats for Fordson and Samson tractors.

Calendar

ENGINEERING

S. A. E. Meetings

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Feb. 6-15—San Francisco, Cal. Third Annual Pacific Automobile Show, Motor Car Dealers' Assn. of San Francisco, Exposition Auditorium. G. A. Wahlgreen, Manager.

Feb. 10 - 15 — Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 12-15—Defiance, O. Second Annual Show under auspices of Defiance Automobile Dealers' Assn.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y., Albany Automobile Dealers' Assn. State Armory.

Feb. 16-22—Waco, Tex. Henry B. Marks, Manager.

Feb. 17-22—St. Louis. St. Louis Auto Mnfrs. & Dealers' Assn. Robert E. Lee, Manager.

Feb. 17-22 — Louisville, Ky. Louisville Auto Dealers' Assn

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan, Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 17-22—Seattle, Wash. Cars, Motor Car Dealers' Assn., State Armory. A. G. Schaeffer, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory. H. M. Lucius, General Manager.

Feb. 18-22 — Oklahoma City, Okla. Automotive Show. R. H. Haun, Manager.

Feb. 18-22—Wichita, Kan.

Feb. 19-22 — Evansville, Ind. Cars, Evansville Automobile Dealers' Assn. Coliseum.

Feb. 22-March 1 — Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben F. Smith, Manager.

Feb. 22-March 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 22-March 1—New Castle, Pa., Lawrence County Association of Automobile and Accessory Dealers.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-March 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-March 1—Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-March 1—Springfield, O.

Feb. 24-March 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.

Feb. 24-March 1—Duluth, Minn.

Feb. 25-March 1 — Erie, Pa., United States Garage.

Feb. 26-March 1—Mason City, Ia. Fifth Annual, Mason City Auto Show Assn.

Feb. 26-March 1—Madison, Wis. Seventh Annual, Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.

Feb. 26-March 1—Quincy, Ill. Cars, Quincy Automobile Trade Assn. Armory.

Feb. —Wheeling, W. Va. Automobile Show at Market Auditorium.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 3-5—Quincy, Ill. Trucks and Tractors. Armory.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8 — Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B. P. O. E. John C. Fowler and George M. Friant, Managers.

March 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s Bldg. R. W. Shreiner, Manager.

March 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gradner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.

March 15-22—Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17 - 22 — Great Falls, Mont. Montana Automobile Distributors' Assn.

March 19-22—St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29—Passenger Cars. April 1-5—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.

March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

March 24-29—New Orleans, La. Henry B. Marks, Manager.

March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.

March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 13-19—Bristol, Tenn. Cars, trucks, tractors, airplanes and accessories. Bristol Chamber of Commerce.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Feb. 15-22—Minneapolis, Minn.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show. Wichita Tractor and Threshing Club. Forum.

Feb. 24-March 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

RACES

March 15—Santa Monica, Cal. Speedway.

May 17—Uniontown, Pa., probably 112½ miles.

July 5—Cincinnati, O., Speedway.

CONVENTIONS

Feb. 19—New York, 13th annual banquet of Aero Club of America, Waldorf-Astoria.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Feb. 25-28 — Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

Improvements in New Mitchell

CHICAGO, Feb. 8—The new Victory model Mitchell on exhibition for the first time at the showrooms on Michigan Avenue has been entirely remodeled. The body lines have been improved by a bevel edge, while upholstery, top and other appointments are superior to the pre-war light six. A thermostat now controls the temperature of water, intake gases and air. The new car has a 120-in. wheelbase, using tires 34 x 4, and powered with a 3¼ x 5-in. engine. Some of the major improvements consist of a deeper frame, stronger rear axle, better brake layout and ball-bearing steering gear. The new crankshaft shows 35 per cent increased tensile strength. The long cantilever springs of last year have been retained. The new model sells for $1,475 f.o.b. Racine, and comes in a five-passenger touring and three-passenger roadster, both at the same price. The standard finish is green with black hood and fenders.

New Manufacturers' Representative

CHICAGO, Feb. 10—The Miller-Cave Corp. has opened offices in the People's Gas Building, Chicago, for service to manufacturers as sales representative to the automotive industry.

Franklin A. Miller, president and general manager, was with the Stromberg Carbureter Co. for several years in the sales department and later as advertising manager. For the past four years he has been connected with the western advertising department of the Cosmopolitan. Robert R. Cave, vice-president, has recently returned from the Government service as a divisional procurement officer. C. E. Sedweek, secretary and treasurer, has also just returned from a captaincy in the Army Transport Division.

Wright-Martin Turns Out Combination Liberty-Hispano-Suiza

NEW BRUNSWICK, Feb. 10—About 2000 workmen are still employed by the Wright-Martin Aircraft Corp. on a Government airplane engine contract, which will be completed in about a month. It has developed an airplane motor combination of Liberty-Hispano-Suiza, and has a four- and six-cylinder engine completed.